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PC WORLD

December 1992 $3.95

THE TOP 200

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3 GREAT ROUNDUPS

- 30 Desktop Rockets
- 17 Hi-Res Color Displays
- 11 New Super-Res Lasers

2 BUYERS' GUIDES

- 83 Fast Video Cards
- 31 Bargain Tape Drives

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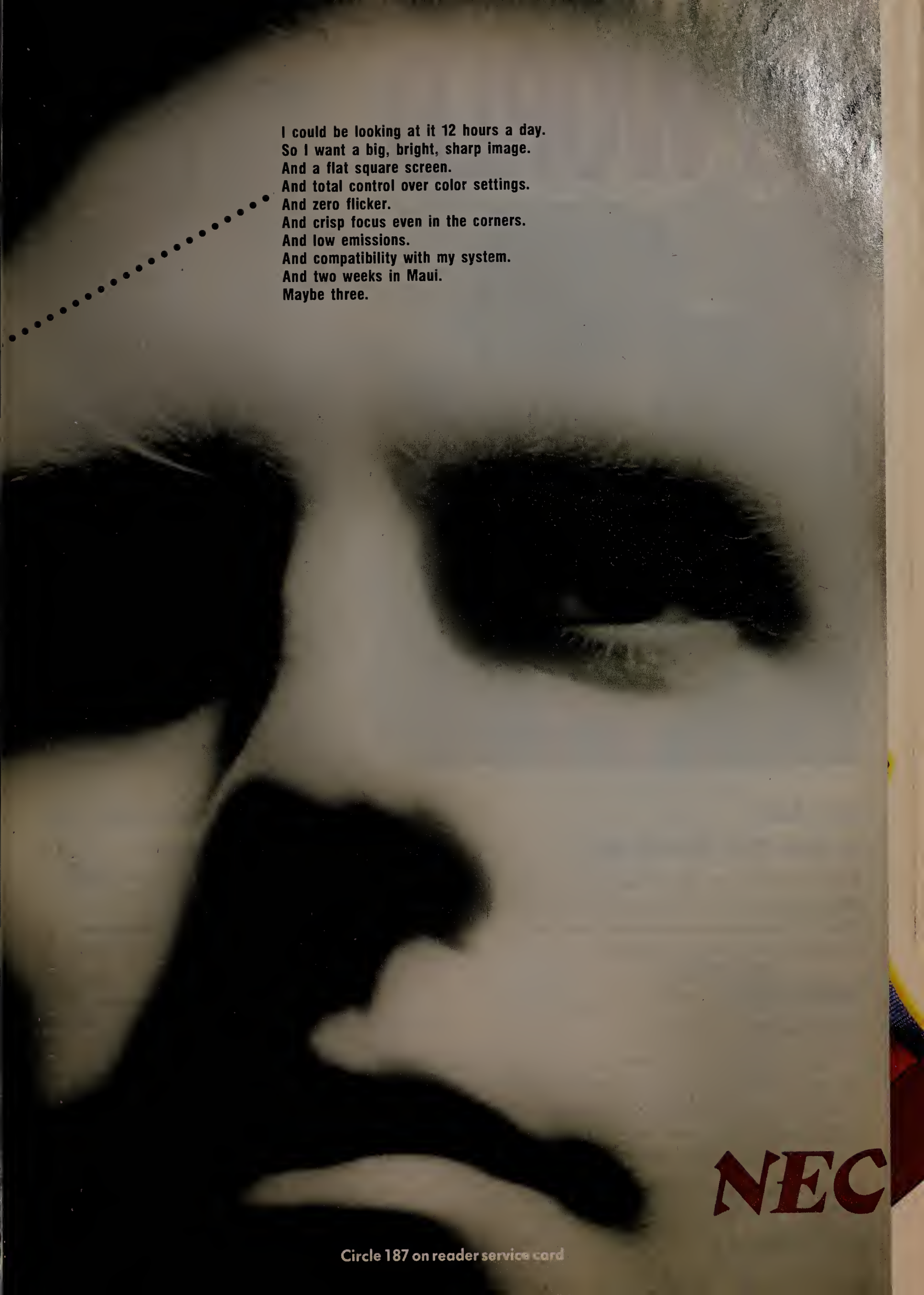

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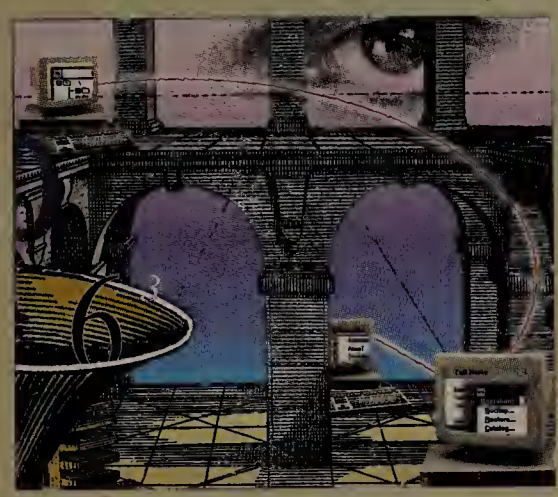

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Pick your power! 486SX-25 thru the 486DX2-66. And upgrading is easy with our Zero Insertion Force (ZIF) socket. Note the extra row of pins for the future OverDrive™ processor based on Intel's P5 technology.

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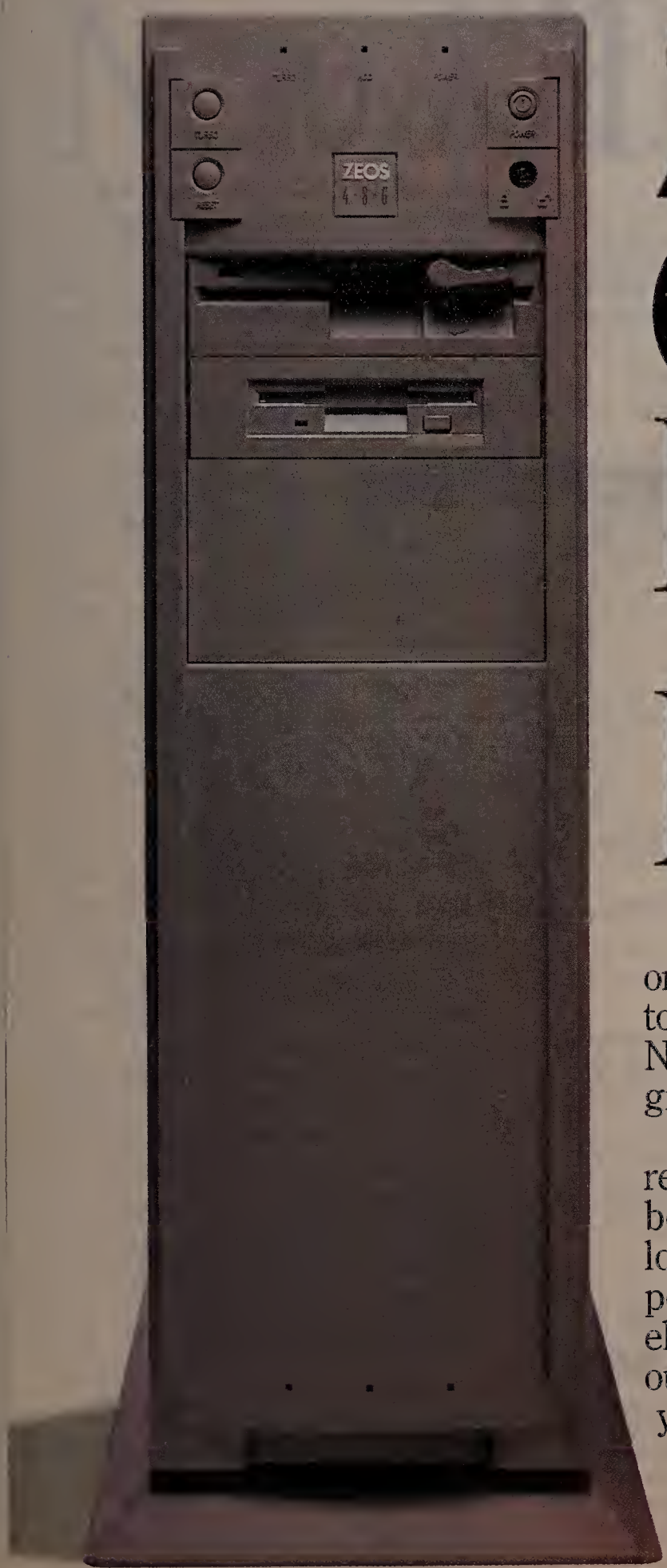

ZEOS® Gives You More.

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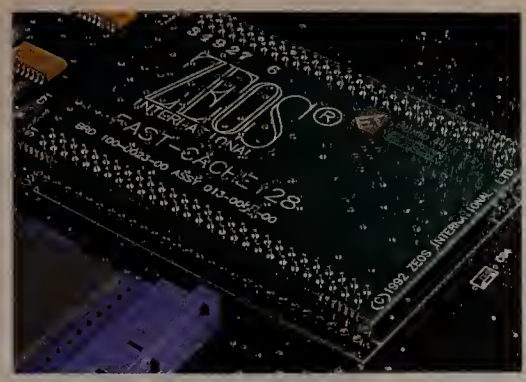
So come on in and take a look at the new ZEOS PCs. They're simply the best deal going. You'll love 'em. Call today!

Flash BIOS enables you to easily implement BIOS upgrades via modem or disk.



You can upgrade your system now or in the future with our optional 128K or 256K secondary cache modules.

New ZEOS® PCs!

cache. Plus other ZEOS performance options. Like your upgradable high-speed cache!

You simply get more. For less. When everyone else is cutting prices by giving less, ZEOS had a better idea—Use the very latest technology to design an entirely new line of high-performance upgradables that allow us to *charge less while giving more.* You're going to love it!

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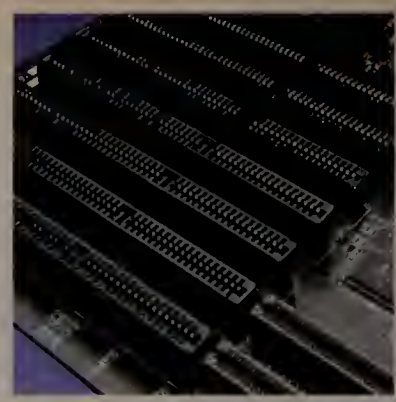
The on-board SCSI option lets you add SCSI I or II devices anytime. SCSI hard drives, opticals and more are easy to add.



Eight expansion slots provide you with plenty of room to add to your system in the future.

Pick Your Power.

ZEOS Complete System Package #1

- Your choice of CPU with upgrade options. Our Zero Insertion Force (ZIF) upgrade socket makes it easy.
- 2MB of high-speed RAM expandable to 64MB on board.
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486DX2-50	$1995	$2595	$2895	$3495
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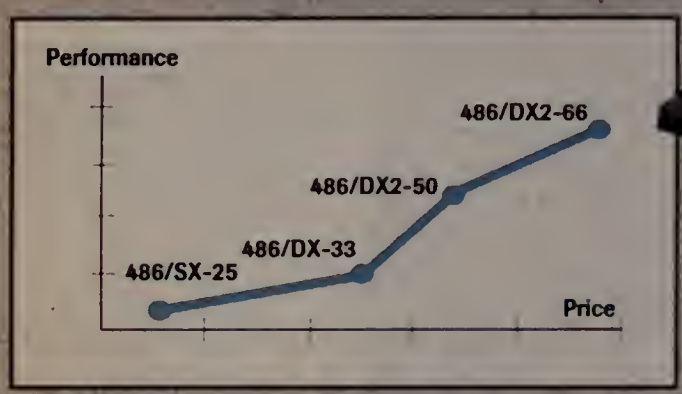

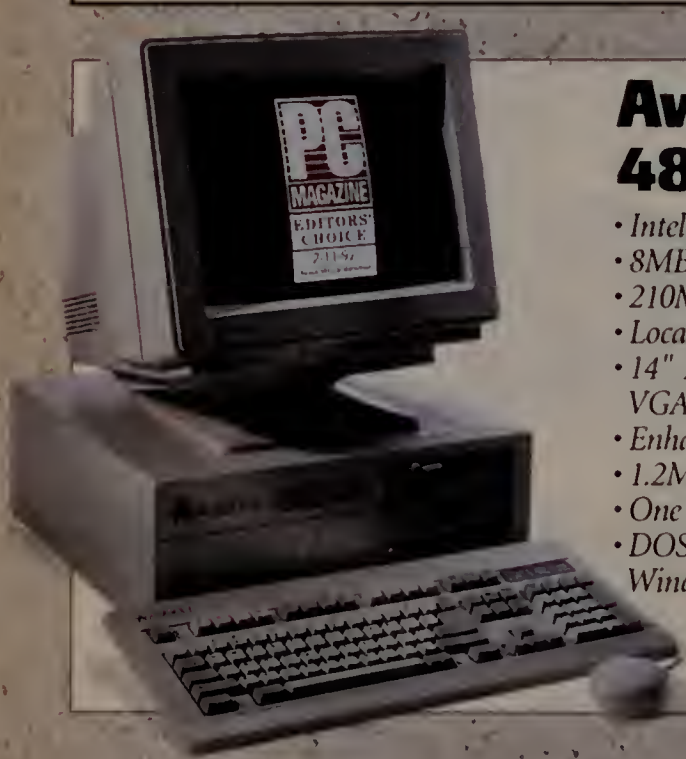

Award-Winning 486/33 WinStation

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PC MAGAZINE EDITORS' CHOICE
February 11, 1992
Austin 486 33i WinStation

"Most bang for the buck!"

"The Austin 486/33i WinStation packs a lot of performance and expansion into a compact package. It is attractive, aggressive and affordable."

PC Magazine Contributing Editor Winn L. Rosch

A U S

PCW-AE-2

486/SLC-33 WinStation	386/33 WinStation	486/DLC-40 WinStation	486/33LB WinStation	486/DX2-50LB WinStation
Cyrix 486SLC, running at 33MHz	Intel i386, 33MHz w/64K Cache	Cyrix 486DLC, 40MHz w/64K Cache	Intel i486, 33MHz w/128K Cache	Intel i486DX2, 50MHz w/128K Cache
4MB RAM (to 32MB)	4MB RAM (to 32MB)	4MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)
80MB Hard Drive	80MB Hard Drive	210MB Hard Drive	210MB Hard Drive	210MB Hard Drive
14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse
Small Footprint Chassis	Small Footprint Chassis	Small Footprint Chassis	Small Footprint Chassis	Small Footprint Chassis
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Intel i486 running at 50MHz w/128K Cache	Intel i486DX2 running at 66MHz w/128K Cache	Intel i486DX2 running at 50MHz w/128K Cache	Intel i486DX2 running at 66MHz w/128K Cache	386SXL running at 25MHz
8MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)	2MB RAM (to 8MB)
210MB Hard Drive	210MB Hard Drive	330MB HD, EISA/SCSI Cont.	330MB HD, EISA/SCSI Cont.	120MB Hard Drive
14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	15" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	15" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	9.4" VGA LCD Display, 640x480 w/ 32 gray scale
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB Floppy Drive Built-In Track Ball
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	79-Key Keyboard
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0 Pre-Installed
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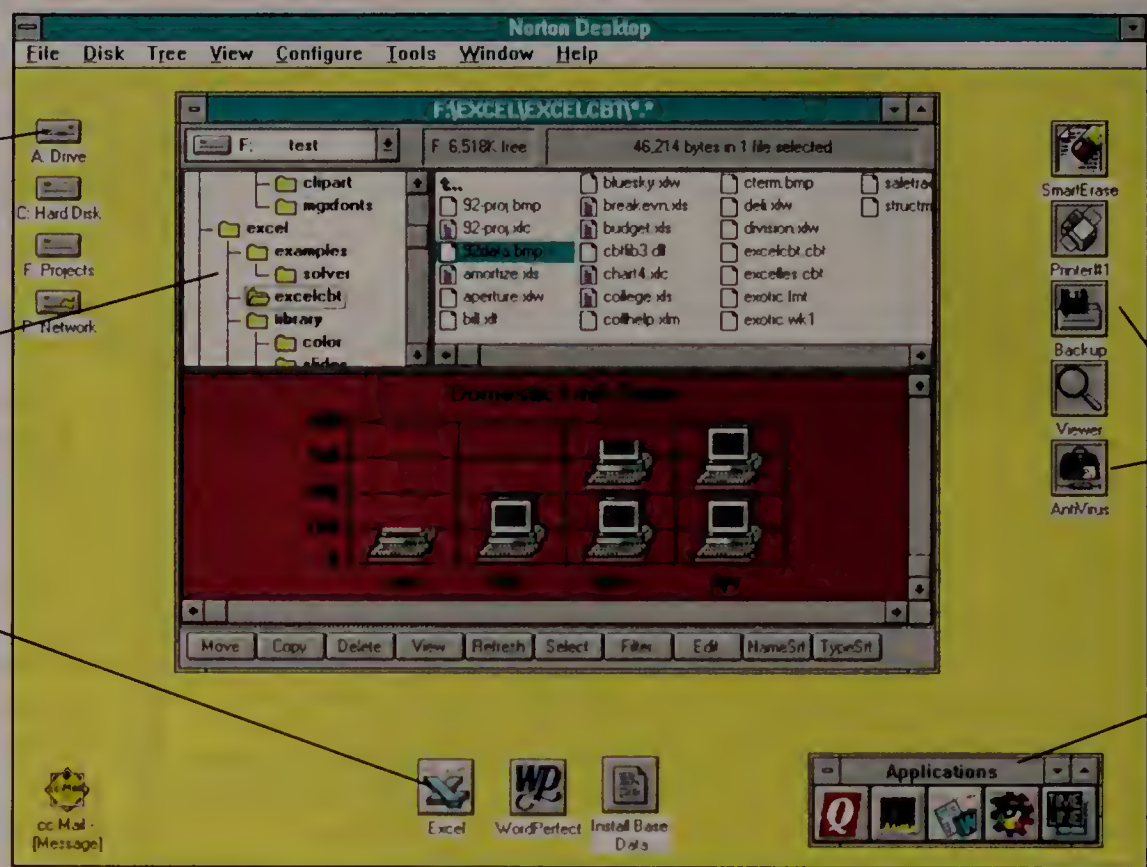
With Norton Desktop for Windows, your drive icons sit right on the desktop, so you get direct access to your files.

Click on a drive icon for easy file management. The drive window includes a tree pane, file pane, and a customizable button bar with a view option.

For total convenience, applications or files can be dragged onto the desktop for easy access. Open files effortlessly with a quick mouse click or, by dragging the file to the application.



The Norton Desktop is a completely integrated environment. You can drag-and-drop files from the drive window to a tool, drive icon, application, or onto the desktop itself.

All the utilities you need to backup, protect, and repair your data sit right on your desktop. You can drag files or drive icons directly to the tool you need.

Keep your favorite applications in a handy customizable toolbox. Launch the application easily with just a click of the mouse.

That's a package full of savings. Norton Desktop for Windows 2.0 enhances Windows in all the important ways. It helps you work faster, smarter, and with better results.

Saves Time.

Something you don't have a lot of. We've improved file management, placing drive icons right on the desktop, so you get immediate access to all your files and applications. Speed search, button bar, viewer, customizable fonts, and collapsible tree structure are all designed to save you time. Full drag-and-drop allows you to drag applications and files out of the drive window to anywhere on the desktop so you have instant access to them.

Saves Money.

We all know time is money. And because Norton Desktop looks so much like Windows, you won't have to waste time learning how to use it. You get most everything you need to run your PC in one comprehensive package — a great, money-saving value.

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Saves Data.

Lost or corrupted data can cost you time, money, and energy. The selection of utilities in Norton Desktop helps you maintain your data. Virus protection and repair, automatic backup, and data recovery can be easily accessed from the desktop; or, scheduled to run unattended, or in the background. Plus, they support all major networks. Norton Desktop for Windows 2.0 is just $179.00 (S.R.P.) at your dealer. Or, call **1-800-554-4403** for an instant FAX Data Sheet (enter 450).** The sooner you get it the sooner you'll save.

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Too Many Cover Stories

We have several worthy cover stories this month—an embarrassment of riches—but have decided after impassioned debate to give the place of prominence to our annual World Class Awards. Our readers picked the World Class winners, the top hardware and software products of 1992, by write-in ballot. We also bring you an abundance of hardware reviews and buyers' guides in this issue, which constitutes a hardware guide for now and 1993, covering 30 desktop PCs, 17 super-VGA monitors, 9 high-res laser printers, 84 graphics accelerators, and 31 tape drives. Our special report on mobile computing shows not only the array of products available in this booming, fascinating field, but also the astonishing range of applications of mobile computing technology. And our preview of Microsoft's Windows NT 3.1 gives you a look at one of the most eagerly awaited software packages ever.

The World Class Awards

You decided the winners of our World Class Awards by write-in ballot. The disadvantage of this approach is that it takes time for us to count the votes. The advantage is that participation is broad and closely tied to the reality of the marketplace. This was a year of many changes in the PC market as *Windows* applications gained market share and DOS applications slipped. During the balloting period, DOS programs still led in many categories, but *Windows* programs were gaining fast. Interestingly, *Windows* won the award for best operating environment but OS/2 won as most promising newcomer.

Hardware Bonanza

Last March our comparison of 486SX and 386-40 desktop systems had the highest readership of any review published in *PC World* in the last three years. (We know this from the telephone surveys we conduct each month. We perform them in addition to tabulating the fax-back poll in each issue.) Prices on machines that use Intel's 25-MHz 486SX and AMD's 386-40, which offer performance in the same general range, have plunged since March. We think the time has come to reexamine the price/performance of these computers and to consider upgradability carefully. To put this month's review in context, we also provide "The Complete Guide to the New CPUs."

Can your eyes see the difference between 300-dot-per-inch printer output and the new 600 dpi? We wondered, so we put ourselves to the test, judging output from an older laser printer against pages from several enhanced-resolution printers and one new printer with a true 600-dpi print engine—Hewlett Packard's remarkable and aggressively priced LaserJet 4. I'll leave it to the review "Next-Generation Lasers" to report our findings.

Special Report on Mobile Computing

What we all really want are wireless, weightless PCs that run forever on a tiny cold-fusion jar and read our minds for input. We're not quite there yet, but this special report shows how far mobile computers have come and how they're changing the way we work and live. There's much more to this field now than just laptops and notebooks. We provide a visual glossary to show you what's what in mobile computing, reports on a wide range of applications, a buyers' guide, and the views of industry visionaries. We think this special report will help you see the possibilities in mobile computing and start planning to exploit them. The report contains a fax survey; by filling it out and faxing it in, you enter a drawing for an AST notebook computer.

Editor in Chief Phil Lemmons has been busy this month overseeing nearly 400 product reviews.

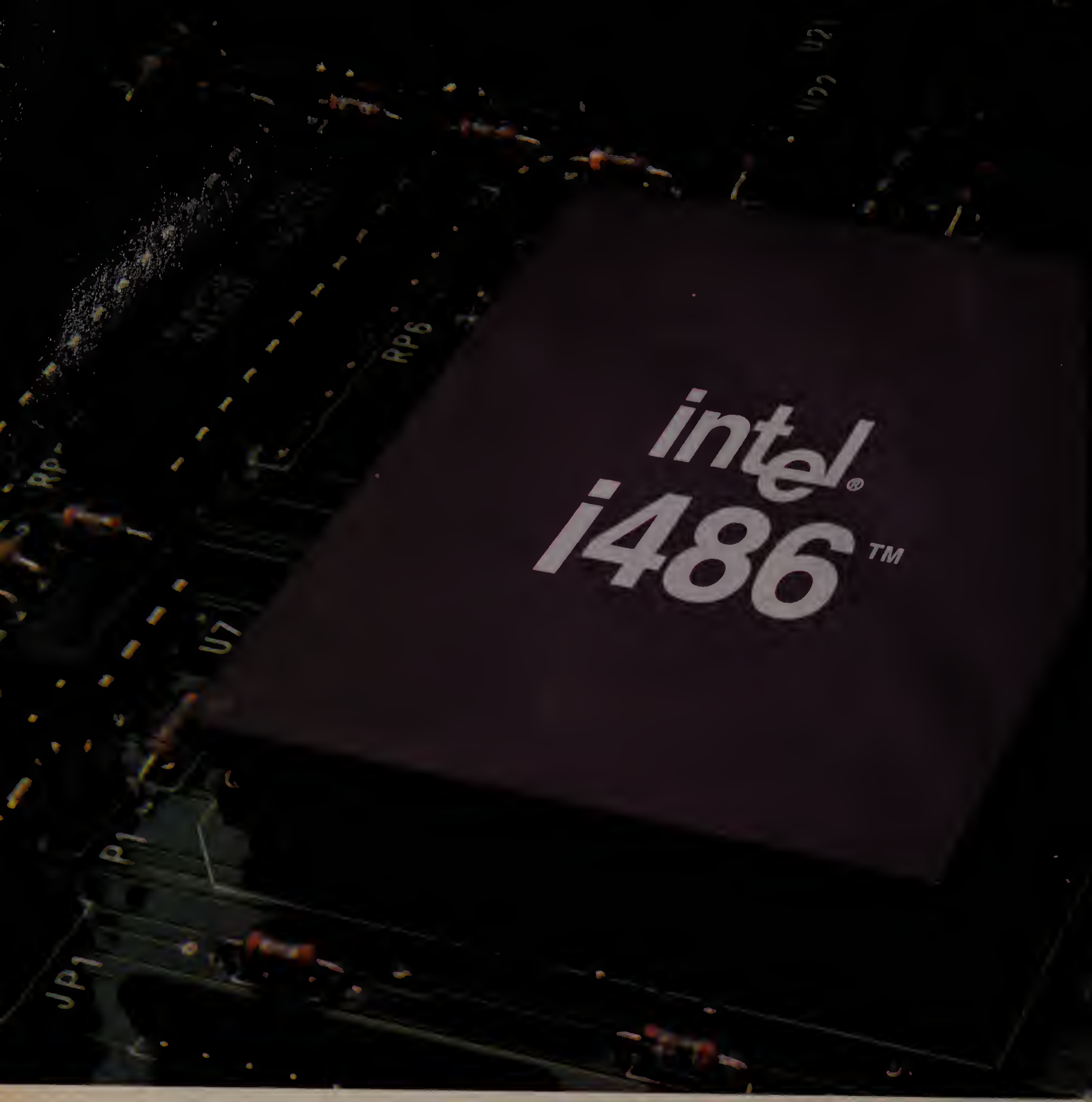
Windows NT Preview

Windows NT is trying to walk the fine line between complete backward compatibility and the introduction of superior new technology. Whether NT arrives in March or October, you can plan better by getting acquainted with it now. We think Scott Spanbauer's preview of Windows NT will help you prepare.

Be sure to fill out and fax in our regular survey about this issue. The prize in this month's drawing is nothing short of spectacular—a true 600-dip Hewlett-Packard LaserJet 4.

Phil Lemmons

Phil Lemmons, Editor in Chief



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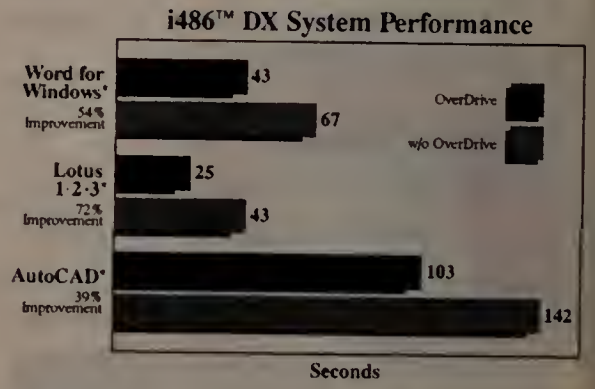

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The Press and Fraud, Giant Clams, Help for Lawbreakers . . .

Is the Press Culpable?

I read with great interest your recent articles on computer mail-order scams. It's true that consumers must be careful. But I have always thought that the computer press had the greatest responsibility for the scams promoted on the pages of their magazines. We consumers can try to protect ourselves from these scams, but the magazines must clean up their act and stop selling ad space to anyone who can afford it. We rely on the information you provide. If we can't trust the computer press, why should we read it?

Gary Nelson, Kansas City, Missouri

Editor's response: Computer magazines don't benefit from fraudulent ads. We are actually among the biggest victims of mail-order scams because the scam artists don't pay their advertising bills. The magazines incur the considerable cost of printing the ad pages and distributing the magazines nationally. Our company lost more than $140,000 to the scam artists we exposed in "Consumer Watch Special Report: Scam!" last May. We also lost the goodwill of the readers who were victimized.

Our magazine makes determined efforts to validate the credit of advertisers, before running their ads, in order to prevent our readers and ourselves from falling victim to fraud. Our credit researchers are especially on the lookout for repeat offenders.

Unfortunately, scam artists are sometimes skillful enough to fool us, too. They change their corporate and personal identities and use clever schemes to vouch for one another. And, because these companies are privately held, credit agencies have very little information about them. Skillful scam artists succeed in evading powerful law-enforcement agencies as well as private credit checks.

We pledge to investigate vigorously any company that succeeds, despite our best efforts, in using our pages to defraud our readers. We hope this pledge, together with the arrest of some of the principals in the fraud we uncovered last May, will keep *PC World* free of fraudulent advertising. The May article shows that national editorial coverage can still inspire law-enforcement agencies to bring crooks to justice.

New Wave Defended

Robert Luhn's review of *Windows* shells ["The Windows Shell Game," September 1992] did a serious injustice to Hewlett-Packard's *NewWave*. It is apparent that Mr. Luhn does not understand what the *NewWave* concept is and is not meant to be.

NewWave brings Mac-like file associating and naming to the PC. It automatically creates icons with friendly file names that visually clue the user to the applications that created the corresponding data file. It allows the names of these objects to be 32 characters long and to utilize uppercase and lowercase lettering along with spaces. It is curious to me that this most salient feature was never mentioned in the article.

The review also states that all *Windows 3.1* groups are "blown away" during installation. This is utterly false! The *NewWave* desktop allows users to organize objects via folders and the file drawer at their own discretion. *Windows'* Program Manager and File Manager are left completely intact as they existed prior to installation.

While *NewWave* does have certain shortcomings, it gives us a system and interface that is far more friendly than anyone reading your article would possibly believe.

Perry C. Caplan, York, Pennsylvania

Editor's response: I don't think *NewWave* was the victim of injustice, merely of accurate reporting. The shell is fundamentally flawed on so many levels—flaws that Hewlett-Packard has readily admitted to me—that most *Windows* users will opt for other solutions. Although *NewWave* provides Mac-like file associations, the shell is so rigid when managing programs and files as to be almost useless. And though 32-character file names are certainly advantageous, they don't compensate for *NewWave*'s cornucopia of bad design decisions. It's true that you can slip out of *NewWave* and access File Manager and Program

Manager, but then, why bother with *NewWave* at all? My point was that *NewWave* fails to translate groups that you've already established into some useful form—everything is dumped onto the desktop, and that's all. *NewWave* is about the most user-hostile shell I've seen. —*Robert Luhn*

Shells? What About the Giant Clam?

I read September's "The Windows Shell Game" with interest. You compared and contrasted Hewlett-Packard's *NewWave* and *Norton Desktop for Windows*. But I think you should have reviewed a third package—OS/2 2.0.

When you total the disk requirements for DOS 5.0 (nearly 3MB) and *Windows 3.1* (about 9MB for enhanced mode), then add a 10MB permanent swap file for *Windows* and the disk requirement for one of the reviewed shells, you end up with a 29MB to

Once Again, CA-SuperCalc's Numbers Crunched 'Em.

VARBUSINESS
Spreadsheet Report Card 1992

PRODUCT FEATURES	Average Score	Access Tech.	Computer Assoc's	Lotus	Microsoft
Ease of use	7.01	6.70	7.00	6.81	7.52
Memory requirement	8.40	6.82	6.89	5.71	6.18
Ease of programming	6.48	6.33	6.58	6.32	6.69
Ability to manipulate data	7.35	7.60	7.29	7.00	7.52
Sorting capabilities	6.90	7.67	6.64	6.58	6.73
Provision for software security	5.65	5.87	5.67	5.32	5.75
Report writing capabilities	6.14	6.57	6.28	5.89	6.82
Ease of use of interface	6.82	6.75	6.70	6.18	7.63
Software integration capabilities	6.84	6.94	6.82	8.32	7.31
Ease of data retrieval	7.41	7.56	7.52	7.10	7.44
Satisfaction with product profitability	6.21	6.47	6.44	6.05	5.89
Overall quality of product	7.48	7.28	7.72	7.18	7.78
Product features average	6.73	6.80	6.80	8.37	6.94
SUPPORT FEATURES					
Provision for customer support	5.88	5.06	6.97	5.47	6.02
Charges for training time	5.17	4.38	5.95	5.05	5.29
Provision for technical support	5.76	5.20	6.60	5.40	5.85
Provision for marketing support	5.65	5.00	6.40	5.43	5.75
Documentation & product information	8.85	8.25	7.27	6.77	7.13
Frequency of updates & revisions	5.99	6.06	5.95	5.84	6.10
Support features average	5.88	5.33	6.52	5.66	6.02
OVERALL AVERAGE	6.45	6.31	6.71	6.13	6.63

VARBUSINESS
March, 1992

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31MB disk requirement for *Windows 3.1* with an advanced user interface. As far as RAM goes, *Windows 3.1* requires from 3MB to 4MB. If you add a shell, you'll need 6MB to 8MB.

For half the cost of the shells reviewed ($79), OS/2 2.0 fits the above disk and memory requirements and throws in additional features such as preemptive multitasking, crash protection between applications, advanced batch file programming, and more.

Chris Novak, via CompuServe

Good but Not Perfect

I want to applaud *PC World*'s selection of the experienced Ralph Grabowski and his excellent report, "CAD Software Under $1000," in your October issue.

I'd also like to point out that in the features table on page 215 under the listing for American Small Business Computers' programs—*Design CAD Professional, Design-CAD 2D, Design CAD 3D,* and *VinylCAD*—the two columns headed Parallel Lines and Boxes are all marked N for no. They should have been marked Y for yes because all four programs perform both functions.

Keith Campbell, vice president marketing, American Small Business Computers

The Cost of Obeying the Law

I just read the article in September's *Industry Outlook* concerning software licensing. I'm glad that vendors are finally doing something to prevent users from inadvertently breaking license agreements for software used on LANs. But I'm concerned about the way they're doing it. It will be a number of years before something is in place, and that something will be metering, not protection.

Metering, I assume, would tell me how much the program is used and how many times we reach the maximum number of users. This is very nice, but if it doesn't *prevent* inadvertent license violation, then I am not interested. In fact, I am opposed to metering because it can be used against me in a court of law.

We currently use *Quattro Pro* in our office. And if I have anything to say about it, we will continue to use *Quattro* instead of *Excel* or another program because *Quattro* has a mechanism to *protect* us from license violation.

Jim Alexander, via CompuServe

Love to Read About DOS

I read with satisfaction your August *Industry Outlook* item "DOS Applications Still Dominate." There will always be people who need or want more power, speed, and capability in hardware and software. But there are many of us who don't need or want the extra expense or bother. My present needs are well met by a 286 with a monochrome monitor, a 20MB hard drive, and DOS.

Charles S. Taylor, Wichita Falls, Texas

I'm a recent subscriber to *PC World* and an avid reader of anything in print that deals with computers. I also subscribe to other computer publications and buy some magazines from newsstands occasionally. To date, I have found none that compare with *PC World* and wish I had joined the fold ▶

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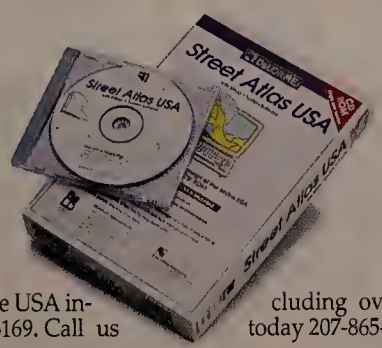

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We didn't start the PC price war.

(Price isn't everything.)

long ago. I used to read other magazines cover to cover before they became so engrossed in *Windows*. But *PC World* remains a cover-to-cover feast because you have not decided that DOS is antiquated.
Robert Meade, Daleville, Alabama

Happy With My Three-Legged Table

I am the satisfied owner of a "three-legged card table" [see August's *What Next?*]. My 386 computer enabled me to write this letter; it keeps my family's finances straight and does all that I expect and more. I can understand why Intel, having lost effective control of the market, has declared the 386 dead. But I can't understand why the computer press insists on repeating the Intel company line. Why shouldn't I take advantage of low prices on these very powerful machines that you call three-legged tables?
Roberto Rivera, Annandale, Virginia

Software for the Professions

Thank you for your August article "Software for the Professions." I'm an aspiring consultant, and this article gave me many new ideas, plus information usually found only in trade journals.
William Wodarczyk, via PC World Online

When the Upgrade Isn't Better

I recently upgraded to newer versions of my cherished staple software after reading positive reviews in various magazines. The results were less than stunning. Traveling Software—whose claim to success was elegant and complete control over file transfers through *Lap-Link Pro*—no longer provides the option to see or copy hidden files. They also deleted the desklink feature that allowed resource sharing between PCs. I need to retain the earlier version to manipulate hidden files and compensate for omitted features.

And Quarterdeck's extraordinary productivity achievement was in *Desqview 386*'s ability to multitask DOS programs—even graphics-based programs. But the new, graphical *Desqview/X* no longer multitasks DOS graphics-based programs. It freezes them in the background.

Unfortunately, such surprises are common today. Many pretty changes are implemented at the expense of functionality and larger file size. It would be a great service to readers to include a table comparing the fea-

tures and program sizes of old versions and their upgrades to compensate for some of the happy-hour decisions made by software vendors.

Ernie Leute, Marlboro, New Jersey

Where Is Multimedia World?

I subscribe to *PC World* and noticed that my issue did not contain the *Multimedia World* insert. I had to buy one. What gives?

Rob Richter, via PC World Online

Editor's response: Subscribers to *Multimedia World* receive the Multimedia Special Section in their *PC World* every other month. Newsstand copies of *PC World* also contain the special insert. To subscribe, call *Multimedia World* at 415/267-1755.

PC World Online?

I am confused—why doesn't *PC World* acknowledge that you can be contacted through America Online? It seems you are ashamed to admit that there is a mode of communication other than CompuServe.

Every time I log on to America Online, I check the Letters to the Editor bulletin board, and I don't remember ever reading a letter from these boards in printed issues of *PC World.*

Ken McDade, via PC World Online

Editor's response: Check out the masthead for information on contacting us through America Online. A number of letters from the Letters to the Editor board on PC World Online and from MCI and CompuServe appear in this and previous issues. Not only do we sometimes print letters posted on PC World Online, but it's a good way for you to ask the editors questions, download shareware programs referred to in printed articles, and converse with other *PC World* readers.

Corrections

In "Stretching Your Upgrade Dollar" in September, we should have said that a 17ms 200MB IDE drive could be had for around $450.

The news item on The Davidsohn Group's antivirus program *Vaccine 5.0* in October's *New Products* should have listed the phone numbers as 800/999-6031 and 212/422-4100. Despite the impression conveyed in the article, *Vaccine 5.0* is actually an upgrade of a product that has been publicly marketed since 1986.

In the features table of our October review of 50-MHz 486DX2 systems, we incorrectly reported the software bundles for the Acma 486DX2-50, the AST Power Premium 4/50d, the Axik Ace Cache 486DX2-50, and the Tandy 4850 EP. The Acma 486DX2-50 comes with *Microsoft Works for Windows;* the AST Power Premium 4/50d ships with DOS 5.0 and *Windows 3.1;* the Axik Ace Cache 486DX2-50 includes DOS 5.0 and *Windows 3.1;* and the Tandy 4850 EP ships with *Microsoft Works for Windows.*

PC World regrets the errors.

Mail your reactions, responses, and ideas to Letters, PC World, *501 Second St. #600, San Francisco, CA 94107; or send them electronically to PC World Online, Letters; CompuServe, 74055,412; MCI Mail, PC World Editorial; or 415/442-1891 (fax). Include your name, city, state, and phone number. We reserve the right to edit letters.* ■

We didn't start the PC price war.

(This is where we draw the line.)

Now we'
the shot

486N Specifications • 32-bit Intel SX, DX and DX2 processors at 25, 33, 50 and 66 MHz. • 4 MB RAM, expandable to 48 MB • Local bus integrated Ultra VGA+ Video with graphics accelerators • 85-430 MB hard drive • 3.5" floppy drive • Three 16-bit expansion slots • ROM-based internal diagnostic and system guide • Integrated Flash BIOS and boot-ROM • Multilevel hardware security • Chip-upgradable

*Suggested U.S. list prices for HP 486/25N and HP 486/33N Model 1 PCs. †Press 1 for HP First, reference Document ID 6310, 6311, 6313. Microsoft is a U.S. registered trademark of Microsoft Corporation. Windows 3.1 is a product of Microsoft Corporation. The Intel Inside logo is a U.S. trademark of Intel Corporation. © 1992 Hewlett-Packard Company PPG-656

HP's new low-priced PCs don't surrender features.

Those cheap PCs don't stand a chance. Hewlett-Packard has introduced 486 models starting at under $1,200.* With prices of our entire line of HP 486 and 386 PCs down as much as 42% in the last 9 months.

But our low prices have not come at the expense of quality, performance or the features you want.

To scream through those high-powered Microsoft® Windows and CAD projects, our revolutionary local-bus technology and fast graphics accelerators really fly. And, with true multivendor compatibility, HP PCs fit easily into your computer environment.

We've also made big advances on the networking front. Many models come with preinstalled network interface cards and boot-ROMs. And, of course, HP PCs are fully tested and certified with all the major NOSes.

Our security features are so convenient people actually use them. And our 486 desktop PCs are chip-upgradable. So you can count on always having the latest and greatest.

All this for as little as $1,200! And for a few hundred dollars more, we'll throw in a hard drive with preinstalled DOS 5.0, Windows 3.1 and a mouse.

To be a winner in the price wars, call **1-800-752-0900, Ext. 7094** for your nearest HP PC dealer. Or call 1-800-333-1917 from your fax handset for immediate details.† Then start calling the shots.

HEWLETT PACKARD

FREE LABOR.

Tired of drawing and redrawing the kitchen sink? The circuit board? The window frame? Now, AutoSketch® for Windows™ does the work for you. With a library of over 2,000 professionally drawn symbols included in this precision drawing program, you can quickly create everything from org charts to floor plans to design diagrams.

You'll be saving more than just time. Auto Sketch includes 13 incredible libraries of symbols–$500 worth–absolutely free. That's more symbols than most any other CAD program on the market.

Add to that an intuitive graphical interface, SmartCursors,™ on-line help, SketchTools,™ OLE support and DXF™ file compatibility. Now you've got a quick and effortless way to transform your rough sketches into production-quality technical drawings.

So give us a call at **1-800-228-3601** and ask for infopak A66. It's got everything you need to know about AutoSketch for Windows... including the kitchen sink.

AUTODESK

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Circle 12 on reader service card

KLH Computers Stops Production but Vows to Honor Warranties

KLH Computers, a Houston, Texas, manufacturer of desktop and notebook PCs, has announced it will stop all production. The company has been operating under Chapter 11 bankruptcy since April. Pending approval from the bankruptcy court, KLH plans to continue providing technical support and warranty coverage for its customers via an independent third-party provider through April 1993.

According to KLH president and CEO Mickey Foret, the industrywide troubles in the PC marketplace, as well as the company's "weak financial condition and small relative industry position," played a key role in the company's decision to halt production.

KLH Computers and its subsidiaries, Premier Computer Innovations and KLH Electronics, distribute their systems through several national mail-order companies and retail chains. The firm produced 110,000 PCs in 1991.

Customers can call KLH's technical support line at 713/270-0756 to get further information on warranty service.

Things Aren't Always as They Seem

Two separate advertisements in the September and October issues of *PC World* attracted the attention—and stirred the ire—of several readers.

TigerSoftware has been running ads (September, page 151; October, page 166) for two CD ROM Starter Packs, featuring a variety of CD ROM titles, for $199 each. (The ad lists the retail value of the items in the bundles at $1652.75 and $1728.65.) But customers who called to order either Starter Pack quickly discovered that they had to buy a CD ROM drive in order to get the great deal on the titles.

We also called to order the Starter Pack and had barely spoken the name of the product before the salesperson told us the bad news. "You can't get the CD ROM without buying the reader," he said, adding that he'd received many calls from customers wishing to buy only the CD ROM titles. "They made a mistake. If I'd read it, I'd think the same thing."

After being contacted by *Consumer Watch*, a spokesperson for Tiger said advertisements normally indicate that the low price on CD ROM titles is available only to customers who also buy a CD ROM drive. The most recent advertisements, in September and October, failed to indicate this. In light of the omission, Tiger told *Consumer Watch* it would sell the CD ROM libraries separately for the advertised prices. This policy had not been implemented at press time.

Similarly, Advanced Logic Research advertisements in our September and October issues (page 10 and page 9, respectively) show a full line of desktop and laptop systems, all for exceptionally low prices. But prospective customers who called to inquire about the systems discovered that the monitors prominently featured with the units were not included in the purchase price.

When contacted, ALR marketing director Jenny Ortegon noted that the fine print at the bottom of the page reads, "Systems shown with optional equipment." She added that ALR has always shown full systems in its ads and suggested that readers were now calling about the ads only because "other vendors are bundling systems and monitors." In fact, only one other company in the September and October issues included a picture of a monitor in its ad that wasn't included in the system's price. That company stated prominently that the monitor was sold separately.

Ortegon says that ALR is changing its ad to indicate more clearly that the monitor is sold separately.

by Roberta Furger

PC World Consumer Watch editor Roberta Furger

Fourth Time's a Charm

Twelve months ago I bought a 386-20 notebook from AST Research in Irvine, California. Since then it has broken down four times. The first time it was the keyboard, the second time it was the screen (which was replaced), the third time there was something wrong with the battery, and the fourth time it was the hard disk. Each repair took two or three times longer than the promised five working days.

The first three times the notebook failed, I had it serviced near my home. But when the equipment failed for the fourth time, I'd had enough and sent the notebook directly to AST. I never got my notebook back, and none of my numerous calls have been returned.

Adolfo Rufatt, Washington, D.C.

Only one electron gets the stamp of app

Nearly 2 million people around the world have given cc:Mail™ a vigorous thumbs up. And for good reason.

LAN TIMES READERS CHOICE 1992

cc:Mail allows you to send messages transparently and maintains a consistent set of features across all these major platforms. That's because it was built from the ground up to support network environments made up of different platforms and LANS – a design consideration that seems to elude most e-mail systems. Further, it's the only system that gives you a wide range of options for enterprise-wide connectivity. cc:Mail can even exchange mail messages with most mini and mainframe mail systems such as IBM® PROFS® and offers gateways to public e-mail services such as MCI Mail.® And cc:Mail runs smoothly on any server or network operating system, in any configuration. All of which makes it easier for you to maintain, administer, and install. And put your faith in.

cc:Mail offers an impressive set of administration tools. Such as Automatic Directory Exchange, a product which automatically collects any changes

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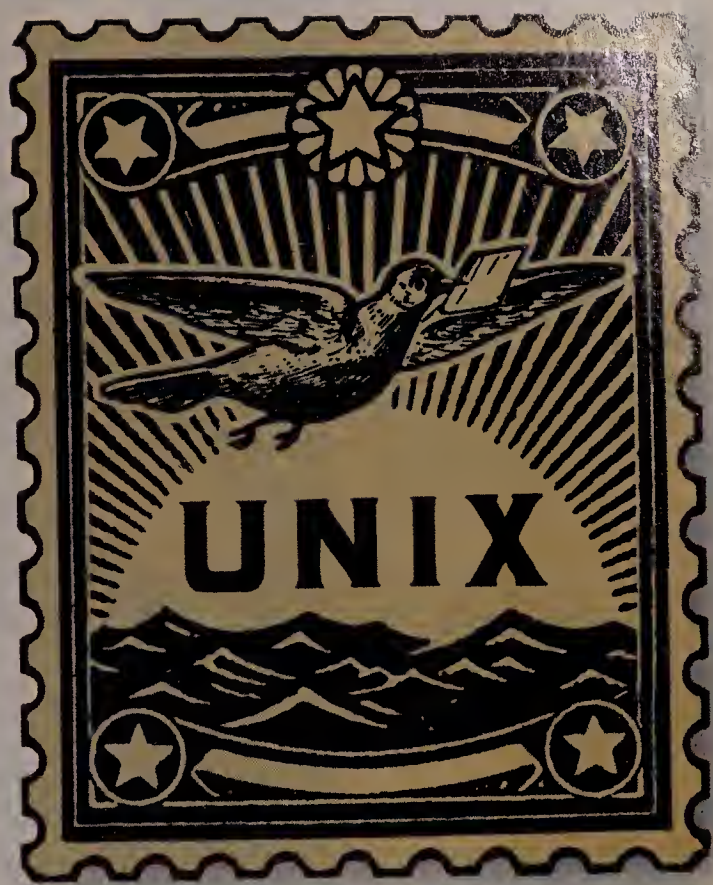


ic mail package roval from everyone.

made to the directory and updates the entire network. It's also the first package of its kind that's built on a new, fully scalable messaging architecture. Which means it can accommodate 5 to 500,000 users. And grow along with your business. One more thing: cc:Mail has won every major industry award, including the Windows Magazine 1992 WinAward and ComputerWorld's 1992 LAN Brand Preference award.

INFO WORLD PRODUCT OF THE YEAR 1991

So if you're looking to standardize your e-mail system, look to cc:Mail, the award-winning system that gives you enterprise-wide connectivity, scalability and reliability–the kind nearly 2 million people count on every day.

1992 BYTE READERS' CHOICE AWARD

For a free demo disk of the cc:Mail Macintosh,® Windows,™ UNIX,® or DOS Platform Pack, **call us at 1-800-448-2500.**

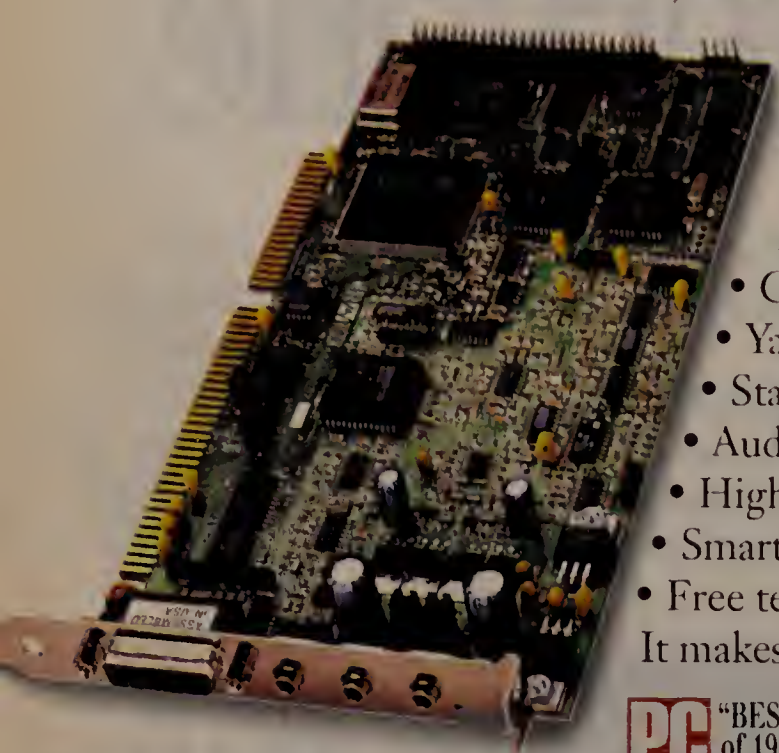
With all the stamps of approval we've received, we're still missing one very important one: yours.

Lotus cc:Mail

Macintosh is a registered trademark of Apple Computer, Inc. Windows is a trademark of Microsoft Corporation. MCI Mail is a registered trademark of MCI Communications Corporation. UNIX is a registered trademark of UNIX System Laboratories, Inc.

THERE ARE STILL A FEW PEOPLE WHO HAVEN'T BOUGHT PRO AUDIOSPECTRUM 16.

Wild as it sounds, Pro AudioSpectrum 16™ is the #1 16-bit sound card in t world — outselling all other sound cards, practically overnight. And here are just a few of the reasons why:



- True 16-bit CD quality stereo audio record/playback at up to 44kHz.
- Fully compatible with the largest library of software including Sound Blaster™, Microsoft Windows 3.1®, Business Audio and MPC.
- CD-ROM ready via a built-in SCSI interface.
- Yamaha OPL3 20 voice stereo synthesizer.
- State-of-the-art audio mixer with 4 watt per channel amplifier.
- Audio compression/decompression.
- High-quality voice recognition and text-to-speech capability.
- Smart configuration software for quick and easy installation.
- Free technical support.

It makes any other solution seem totally primitive.

MICROSOFT WINDOWS COMPATIBLE

PC MAGAZINE "BEST of 1991" Robert Kendall Pro AudioSpectrum Review 1/14/92

PC Multimedia PC

MEDIA VISION

Media Vision, 3185 Laurelview Court, CA 94538. 510-770-8600, FAX: 510-770-9592

Media Vision and Pro AudioSpectrum 16 are trademarks of Media Vision, Inc. All other trademarks are the property of their respective companies. © 1992, Media Vision, Inc.

Circle 145 on reader service card

Editor's response: *Consumer Watch* contacted AST Research on behalf of Rufatt and received this response from David Aburto, director of reseller and customer services:

"We have researched the problem and found that Rufatt shipped his Premium Exec to AST's manufacturing plant blindly; therefore AST was unable to identify the system when it arrived. We need a return authorization number in order to distinguish any system being shipped to AST.

"I would like to apologize, however, for the inconvenience Rufatt experienced with his Premium Exec notebook computer. AST understands the urgency of getting a computer system up and running immediately, and we would like to restore his confidence in our products. We have therefore agreed to replace his system with an upgraded unit."

Vendor replacement of a problem PC is rare, to be sure. But, as Rufatt's experience with AST illustrates, you don't *have* to be stuck with a lemon.

If You Need Assistance, Call the Manufacturer

J. R. Walters of Melbourne Beach, Florida, wrote to us because he was having a difficult time reaching Trident Microsystems, a chip manufacturer in Sunnyvale, California. Walters wrote to Trident because he couldn't get his graphics board to work at higher resolutions.

Consumer Watch contacted Trident, which worked with Walters to identify the problem: His monitor didn't support the higher resolutions. The company even went so far as to ship him a new board that would be compatible with his current monitor.

Besides addressing the problem at hand, Michael Maia, Trident's vice president of corporate marketing, offered this clarification about the role of the chip manufacturer and that of the actual board maker:

"Walters believed that his card was produced by Trident, but Trident does not produce video cards. Trident is an integrated circuit designer and marketer. We produce the graphics controller chip that is sold to many original equipment manufacturers (OEMs). We do not make products for the end user. Other companies, including Intel, AMD, and Chips and Technologies, are in a similar position and suffer from some of the same misunderstandings. We receive many phone calls and letters from end users who believe that we are the board manufacturer, since the graphics controller is the largest component on the board and several other support parts may also have the Trident name.

"Our staff is instructed to explain carefully to end users who contact us for service that we are not a board supplier. Because we receive dozens of user calls every day, we have a customer service department that handles basic customer needs. More in-depth technical issues, however, are forwarded to the board makers.

"We hope that users will refer to their owner's manual or ask their retailer to locate the board manufacturer when they need assistance."

Send My Money, or Else . . .

After 90 days of telephone calls and faxes trying to extract a refund from a mail-order PC company, I obtained an official complaint form from the Pennsylvania Bureau of Consumer Protection. I completed the form and dated it ten days in the future, specifically naming the person who I'd been dealing with at the company. I faxed the form along with a letter saying that if I did not get my check within ten days, the complaint would be filed. I received a phone call within minutes of the fax, and I was told that the refund was being processed. The next morning I received

POWER TIP no. 266

Removing Pages from 1-2-3

Here's a DOS command for converting 1-2-3 3.x files to WK1 format: TRANWKS *source*.WK3 *target*.WK1, where *source* is the file(s) to be translated and *target* is the new name. If your 3-D source file contains multiple sheets, they'll be saved as *target*0A.WK1, *target*0B.WK1, etc. To translate only one sheet from a multisheet file, use the -l*x* parameter, where *x* is that sheet's letter. To run this program from any directory, move TRANWKS.EXE from your 123 directory to one referenced in your AUTOEXEC.BAT's PATH command.

Don Roche, Jr.
Austin, Texas

Making the best better wasn't easy, but we did it "AGAIN"

Introducing
Model 24SII DES
Printer sharing at it's best!

The *New* **Model 24SII DES** data exchange system is printer sharing at it's best. Now network workstations, file servers, graphic workstations, and PCs can off-load print jobs at the blazing rate of **60,000cps parallel** or **46,000cps serial.**

If you want to eliminate the need for multiple laser printers without losing productivity; off-load network print jobs faster; or increase your printing throughput; the Model 24SII DES is for you.

Contact a BayTech representative today for more information on the best printer sharing solutions available.

- *Expandable from 4 to 24 ports*
- *Compatible with Windows®*
- *Computer-to-computer communication for file transfer or modem sharing*
- *Up to 16MB buffer*

SEE US AT BOOTH #N6434
COMDEX/Fall '92
Because Resources Should Be Shared
BayTech
800-523-2702

Circle 38 on reader service card

LaserShare®...

...simply the fastest way to share your laser printer

With 60,000cps parallel, and 46,000cps serial input speeds, the improved LaserShare® is the fastest plug-in *printer sharing* solution available today.

LaserShare gives you the speed advantage of plugging into the printer bus. The 4MB buffer allows your computers to off-load print jobs faster than if they were connected directly to the laser printer.

- *4 parallel port model*
- *4 serial port model*
- *2 serial/2 parallel port model*
- *8 serial port model*
- *RJ-45 connectors available*
- *Printer can be located 1000 feet away from the computers (serial communications)*
- *No external power required*
- *Compatible with HP printers*
- *Easy installation*

Because Resources Should Be Shared

BayTech

800-523-2702

Circle 95 on reader service card

BUG WATCH

IBM OS/2 2.0

Systems that use more than one type or more than one brand of memory chip may crash while running applications under OS/2 2.0. Users report receiving the error message 'Trap # error' before their system locks up.

To avoid the problem, users should install either 9-chip or 3-chip SIMMS, but not both, and should avoid mixing chips from different manufacturers. An IBM spokesperson also advises that systems with 9-chip SIMMS seem to have fewer problems with OS/2 2.0 than those with 3-chip SIMMS.

IBM Corp.
800/772-2227 (customer service)

PC Tools 7.1

Users of *PC Tools 7.1* who keep the utility memory resident have reported scrambled screens if the program pops up when they're running a graphics package or the graphics portion of a software package. If you use *PC Tools* as a schedule reminder, for instance, this can occur unexpectedly.

A spokesperson for Central Point Software said the company is aware of the problem and plans to fix it in the next version of *PC Tools*. Until then, users should run *PC Tools* from the command line when working with graphics.

Central Point Software
800/445-4208

Procomm Plus for Windows

Datastorm Technologies is distributing *Procomm Plus for Windows 1.01*, a maintenance release that corrects several problems in the original version. Among the 41 corrections and improvements are fixes for errors in the ZMODEM, CIS-B, and Kermit protocols. In addition, there are improvements to the dialing directory, terminal emulation modes, and the ASPECT script language.

The maintenance release is free of charge and can be downloaded from Datastorm's CompuServe forum (GO DATASTORM) or from the company's own BBS. Registered users can also obtain a copy of the upgrade through the mail by calling Datastorm.

Datastorm Technologies, Inc.
314/443-3282 (service), 314/875-0503 (BBS), 314/875-0595 (fax)

Microsoft Excel 4.0 for Windows

Excel 4.0 users have reported a bug in the program's Print Titles function. When users try to print a reduced image that also contains title columns, each page of the resulting printout contains columns of text not specified in the print range. (See *Here's How: Spreadsheets* in this issue for more information.)

Microsoft was scheduled to release a maintenance version (4.0a), which would include a fix for the Print Titles bug, in November. It's available on disk for free to registered *Excel 4.0* users by calling Microsoft.

Microsoft Corp.
800/426-9400, 206/882-8080, 206/936-7329 (fax)

—Richard Melville

Have you run into a software bug or hardware incompatibility? Call us at 415/978-3253 with the details. We'll investigate problems and report on those with broadest interest.

Richard Melville is an editorial intern for PC World.

a faxed copy of the check, and the check itself arrived in the mail shortly thereafter.
Dwaine Fugate, Erie, Pennsylvania

Kudos for Micrografx

I've been using *Micrografx Designer 3.1* for some time and have been very pleased with the program. I was grappling with a printing problem, though, and the Micrografx customer service department was not particularly helpful. I wrote two letters to Micrografx about the difficulty, in the hopes of prompting further help, and was astonished to receive a call from company president George Grayson.

Grayson apologized for the weak response from the technical support staff. He noted that the surge in demand for several

of the company's other products had temporarily overloaded its support facilities and said that they were adding to the support staff. He discussed my printing problem with his technical staff and then suggested a solution.

The next day one of his senior technical staff called to discuss the problem further and said the company was trying to solve the problem in an upcoming release. A company with this level of concern for its customers clearly deserves praise.

Keith P. Rhea, Ampro Resources, Missoula, Montana

Editor's response: As it turns out, the latest upgrade to *Micrografx Designer* doesn't have the new printing feature that Rhea was looking for, but he remains a loyal Micrografx customer anyway. Why? Because the company showed its commitment to its customers.

"The phone call from the president really blew me away," said Rhea in a later phone interview. Us, too.

Stuck in the Middle

I recently purchased a 486 system with a noninterlaced, super-VGA Aamazing monitor, model CM8428MX. I bought this monitor because we use Aamazing monitors at my office and they run flawlessly. My monitor ran great for about a month, then it "popped."

I first called Aamazing because the warranty card said the manufacturer handled all repairs. The people at Aamazing told me the warranty card was wrong, though, and that I needed to go through the dealer. After six weeks I did receive a replacement monitor from my dealer, but unfortunately the replacement didn't work at 1024 by 768 resolution.

Aamazing says the dealer should handle the problem, but the dealer has been of no help to me.

Bill Baker, Coarsegold, California

Editor's response: When contacted by *Consumer Watch*, Aamazing customer service manager Tanya Manzo said that customers are asked to contact dealers for service or repairs "to provide users with prompt and personal attention. Most of our dealers will immediately furnish their customers with either a replacement model or a loaner until their defective product has been repaired."

Given the dealer's failure to act, however, Aamazing offered to refund the cost of the original monitor and ship Baker a new monitor free of charge. Baker, however, had already upgraded to a new higher-end display from another manufacturer, so in the end Aamazing refunded the purchase price of his new monitor.

They Make Shopping a Pleasure

With all the scams and poor business dealings I have been hearing about, I wanted all to know that there are some bright spots out there in the PC industry. PC Connection in Marlow, New Hampshire, is a joy to do business with. All the products I've ordered from them have been competitively priced and available when I've called. The products have always arrived on time, and the salespeople have been extremely knowledgeable and courteous. Keep up the good work!

Kelley Martin, Baltimore

Think you've gotten a raw deal—or a great one? Mail the details to Consumer Watch, PC World, *501 Second St. #600, San Francisco, CA 94107; or send them electronically to PC World Online, Consumer Watch; MCI Mail, PC World Editorial; CompuServe, 74055,412; or 415/442-1891 (fax). We'll investigate complaints and publish letters with broadest interest.*

POWER TIP no. 267

Easy Management for cc:Mail Work-Group Messages

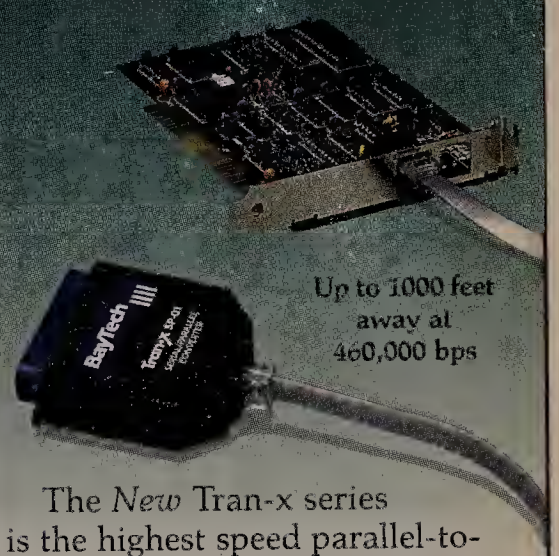
When you're polling a work group in *cc:Mail* on an idea or project, you can wind up with a mess of messages peppered through your in-box or one of your project folders. Extra messages take up storage space and slow down your access to *cc:Mail*. It's much less time-consuming to manage these messages in their own group. Set up a temporary folder and file them as they come in. When you're done reviewing them you can delete the folder and all its messages in one easy move.

Rex Farrance
Assistant Editor

AND "AGAIN"

Introducing the new

Tran-x Series



The *New* Tran-x series is the highest speed parallel-to-serial converter available today. With speeds of 460,000bps, computers can achieve parallel transmission speeds up to 1000 feet away. Printers no longer need to be located near the file server, or workstation.

The Tran-x series is also designed to work with other BayTech high speed printer sharing solutions. For more information contact a BayTech representative today.

- *460,000bps at 1000 feet*
- *3 models to fit your applications*
- *Centronics parallel handshaking line support*
- *Toll-free support before and after the sale*

All product or company names are trademarks of their respective holders.

High Speed Printer Sharing
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Because Resources Should Be Shared

BayTech

Data Communications Products Division
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Fax: 601-467-4551 Phone: 601-467-8231 or toll-free

800-523-2702

Circle 111 on reader service card

Get a better de
on a better 1-2-

Now that's good news for anyone buying a Windows™ spreadsheet. First, we recently updated 1-2-3® for Windows so it now gives you more of the features you've been looking for in a Windows spreadsheet. Second, we lowered the price to just $495.* (Plus, for upgraders, and for a limited time only, we've included the SmartPics™ Clip-art Sampler absolutely free.)

$495

Of course, when you come right down to it, there are plenty of other reasons why 1-2-3 for Windows is the best spreadsheet choice you can make.

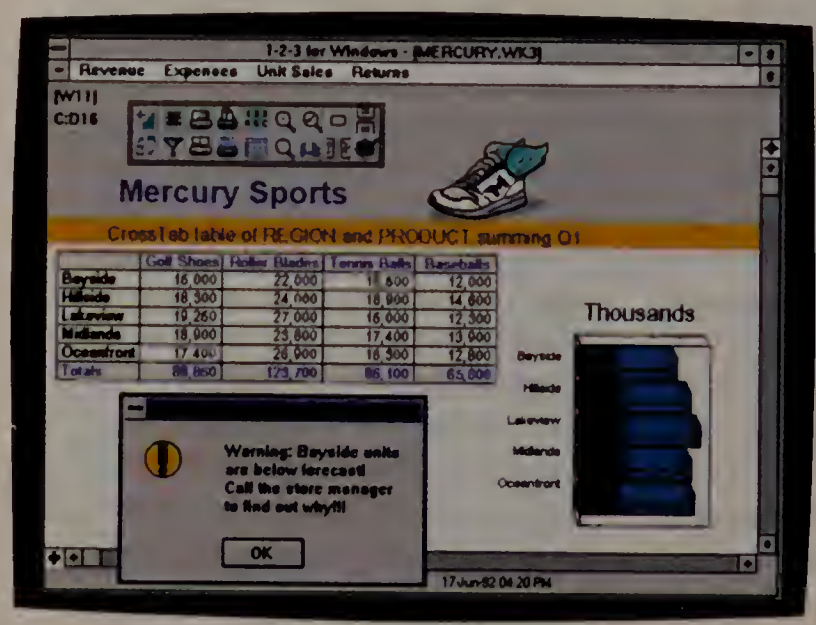
Its features and performance are better than ever.

1-2-3 for Windows now includes more than 25 new features and usability enhancements, as well as a robust set of GUI development tools.

Recent performance enhancements also make 1-2-3 for Windows the fastest-printing Windows spreadsheet for Postscript® output. It also makes the most efficient use of system resources when handling 3D files.

Better still, we're offering license packs for network users so you can set up your network configurations more cost-effectively. All of which makes Lotus 1-2-3 for Windows the best deal in a Windows spreadsheet.

It's a better transition from DOS to Windows.



Only 1-2-3 for Windows, with its built-in Classic® Menu, lets you use familiar 1-2-3 commands whenever you choose. Excel, on the other hand, only supports 80% of 1-2-3 Release 2.01 commands. And has no support for releases beyond.

*Suggested retail price. **In Canada, call **1-800-GO-LOTUS.** Eligible spreadsheet products include 1-2-3, LotusWorks, Symphony, Microsoft® Excel and Quattro® Pro. Please have your credit card and product package ready whe
Lotus, 1-2-3 and DataLens are registered trademarks and SmartPics and Multimedia SmartHelp are trademarks of Lotus Development Corporation. Classic is a registered trademark licensed to Lotus Developmer

al
3.

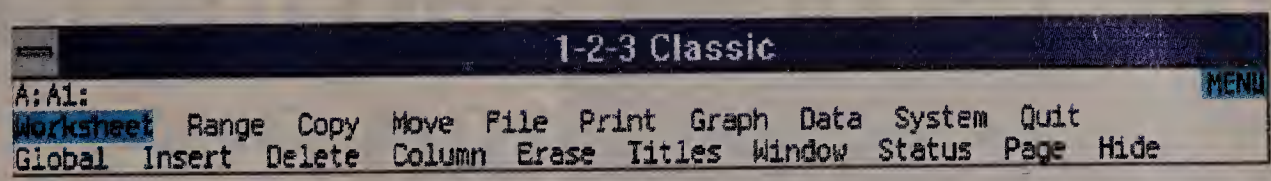
What's more, only 1-2-3 for Windows offers you a better compatibility bridge from DOS to Windows. And unlike Excel, which can't read Allways files, 1-2-3 can read and execute *any* 1-2-3 for DOS file, style and macro.

All of which means you'll retain your full investment in 1-2-3 for DOS files when you move to 1-2-3 for Windows.

Its 3D technology and external data access capabilities are better than Excel's.

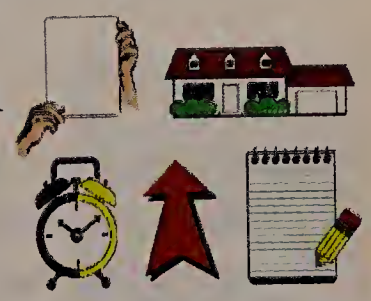
In 3D technology, 1-2-3 is unsurpassed. It gives you easy access to 256 worksheets and lets you build true 3D formulas. Excel's Workbook is a mere imitation. That makes 1-2-3 for Windows a more powerful tool that truly helps you consolidate data, spot trends and make better, more timely business decisions.

Corporate Computing (8/92) wrote that *"for the experienced 1-2-3 database user, 1-2-3 for Windows with DataLens® is the front-end tool of choice."* Excel's data access capabilities rely on a third-party product with limited relational capabilities.



There's no better time to act than now.

Remember, for a limited time only, when you upgrade to 1-2-3 for Windows, we'll give you a SmartPics Clip-art Sampler absolutely free. It includes over 100 clip-art images to help you better communicate through your spreadsheet; it'll do the same with any Windows application.



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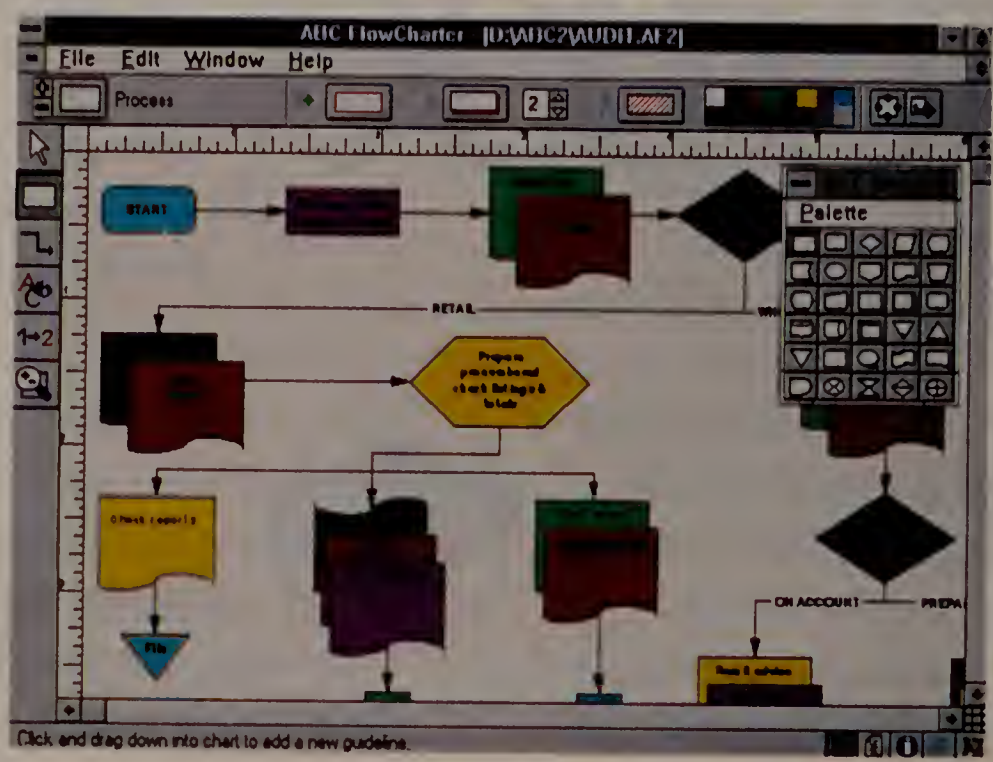

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Circle 179 on reader service card

Overcoming Computerphobia

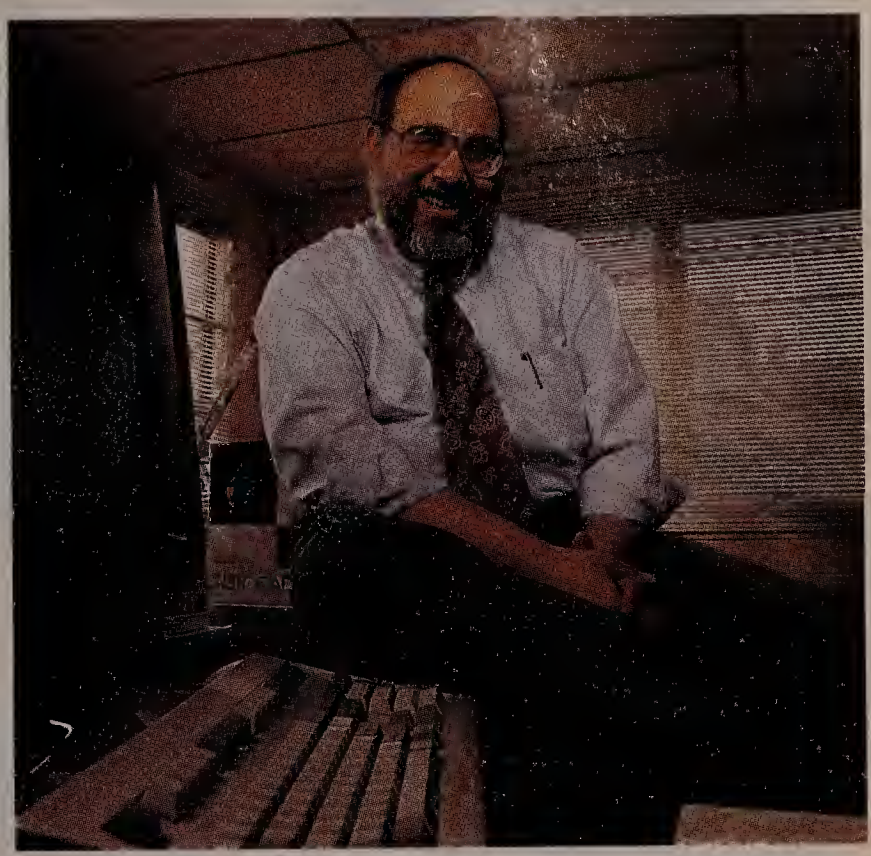
In our continuing mission to help managers get the most out of their computers, we're asking *PC World* readers to tell us how they've addressed knotty management issues. This month, Howard Moskowitz of Toledo, Ohio, shares his experiences in teaching new PC users how to overcome their fears and to work productively. Moskowitz is no stranger to training issues. As the former director of technical support for Fox Software, he's worked with hundreds of new computer users. Moskowitz's current company, HJM Computer Consulting, provides clients with contract programming services, technical support, and training. —*Ed.*

Moscowitz Muses

Have you ever noticed how people who've never touched computers take instructions literally? I've often seen new users, told to "hit any key," frantically search the keyboard for a key marked "any." When told to "use the mouse to move the cursor on the screen," some hold the mouse directly to the screen, or hold it in the air as though it were a remote control. Once a student asked me where to put the "little record" (a 5¼-inch floppy). Some novices become computerphobic and freeze up at the idea of trying anything. The bottom line: countless lost hours of productivity.

Some years ago, I had the dubious pleasure of setting up hardware and software systems for a four-person company in Toledo. At my recommendation, the owner bought state-of-the-art PCs, including oversize color monitors, laser printers, and a local area network. The owner required that his office manager, who already had too much to do, learn *Microsoft Word* and *Excel*, although she had never touched a computer in her life. My partner and I spent a total of nearly 45 hours training her how to use the software.

Six months after we finished the project, we dropped in to see how the office manager was doing. All the training had been to no avail—she remained a confirmed computerphobe. She told me that she didn't have time to practice and that her boss was getting angry. Understandably so: He had spent thousands of dollars on high-end systems, and no one in the office was using them. Worse yet, the weekly reports he'd expected had yet to materialize on his desk.



Howard Moscowitz of HJM Computer Consulting

The boss's solution to this problem was to hire a new employee with some PC experience, to the tune of some $30,000 annually. This employee was responsible for getting the reports out on time and helping the staff use their computers. Although I didn't tell him so, I felt that the owner was throwing good money after bad.

Since then, I've developed a few techniques for working with computerphobes. One of my most effective strategies is to disarm people through humor; sometimes I even use such a silly ploy as asking them to hug the computer. Once new users personalize the PC, they understand that it will work for them. Another tried-and-true approach: Open up the computer and show them what's inside. This makes it less intimidating.

Forcing a new user to work through a manual is like asking someone to climb Kilimanjaro barefoot. A good training class starts students with a familiar task (typing) and lets them work toward the unfamiliar (formatting). Training classes are easy to find at community colleges, universities, and commercial organizations. Look for a program whose courses come closest to your business needs, and one that provides each student a computer to work with. It's also wise to check the track record of the organization and the reputation of the trainer. I've also tried pairing a computerphobe with a more experienced user. Of course, this tactic can have a downside: The computer-literate employee may lose productivity and patience while the new user is busy getting up to speed.

If you're managing several new users, you might consider hiring an outside help desk so your employees can call a toll-free number to get answers to questions. You can find ads for these in most "beginner" computer publications as well as in some management magazines. (Again, be sure to check on the credentials and backgrounds of the technicians, and find out how quickly they respond to calls.)

A few other tricks: As a manager, I try to have at least a passing knowledge of the software I'm asking my employee

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Another Angle

Joel Rakow, president of American Training International, a Los Angeles–based firm specializing in training, comments: Reducing the distance between the human and the computer is an excellent idea. Here are a few other tricks managers can try to help computerphobes make the leap. First, take advantage of on-line tutorials, which come with most current software programs and are available from other sources as well. Disk-based tutorials protect the user from doing anything "wrong," and are gentle, infinitely patient teachers. In addition, they're more cost-effective than training classes: You can use them any time and share them with other users. Some computer-based training (CBT) videos are helpful for the terrified user, though it's a good idea to have someone on hand to translate unfamiliar terms. And of course, there's the old carrot tactic: "If you learn *Excel* by the end of the month, I'll give you half a day off."

to use. I also assure new users that they're smarter than their computers, and I encourage them to follow directions at their own pace. If the user seems about ready to throw the computer out the window or break down in tears, I advise him or her to take a break (staying in a frustrating situation only makes matters worse). Whenever possible, I set a generous time frame for training. Nor is it a bad idea to set up a company user group.

If you use PCs to manage people and other resources in a business environment, we want to hear from you. Send your article idea—including a brief outline of your company, job, problem, and solution as well as your name, address, and phone number—to Real Problems, Real Solutions, PC World, *501 Second St. #600, San Francisco, CA 94107; or send it electronically to PC World Online, Real Problems, Real Solutions; or 415/442-1891 (fax); or call us at 415/978-3224. We pay $300 per published column. Sorry, we cannot acknowledge unpublished materials.*

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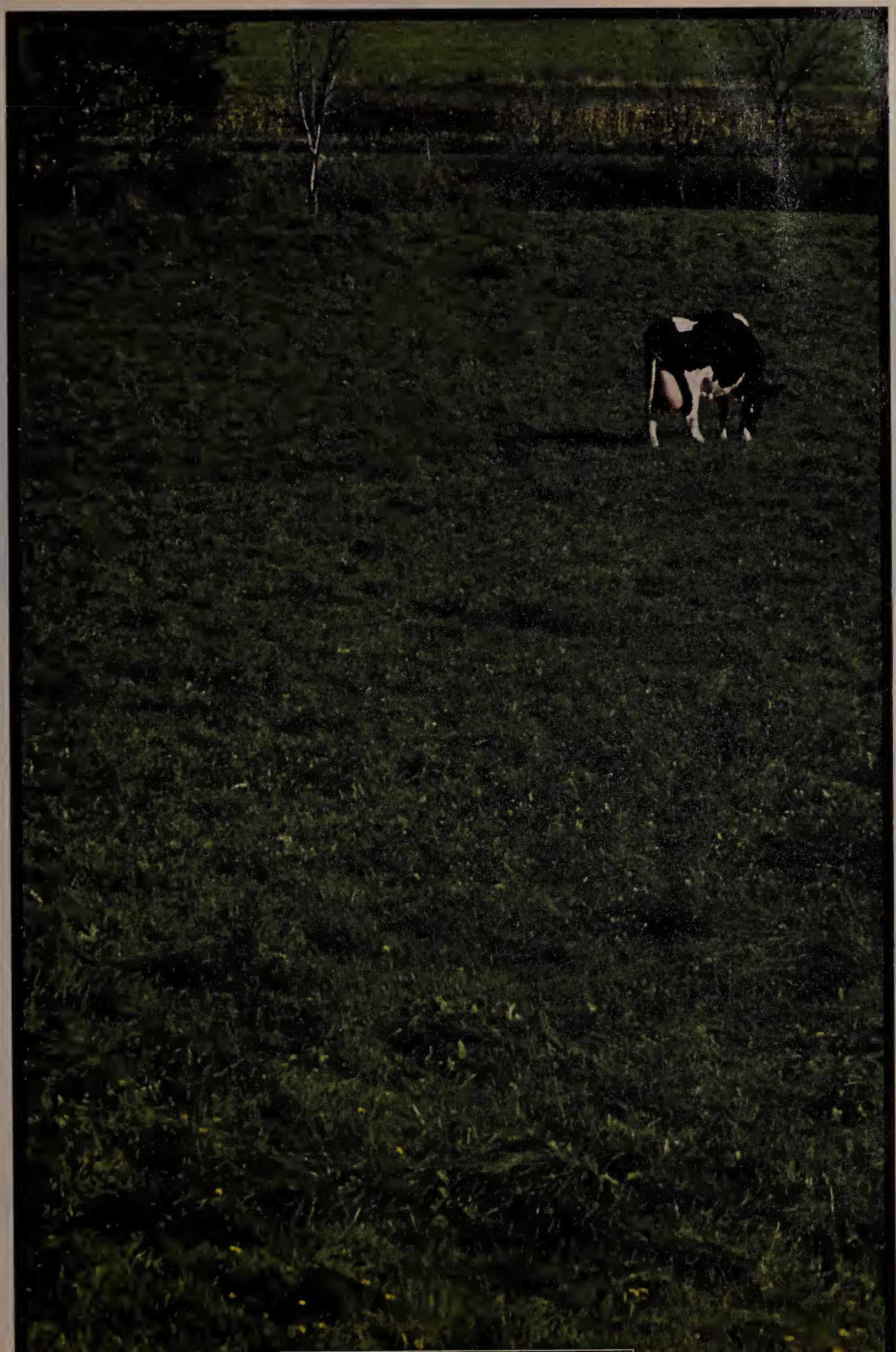

Somewhere east of Sioux City

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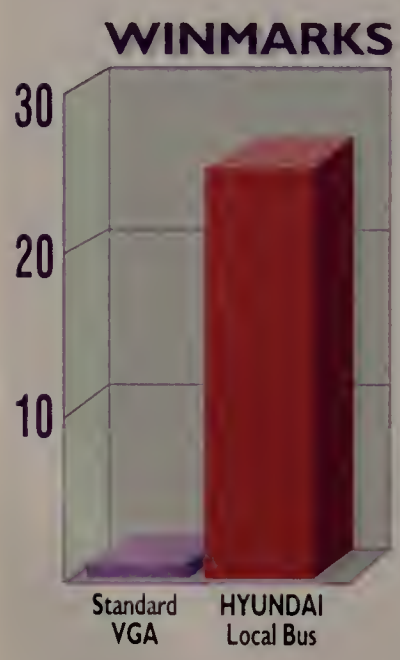

Do something "Longhorn" Local Bus.

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

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Do something thunderbolt.

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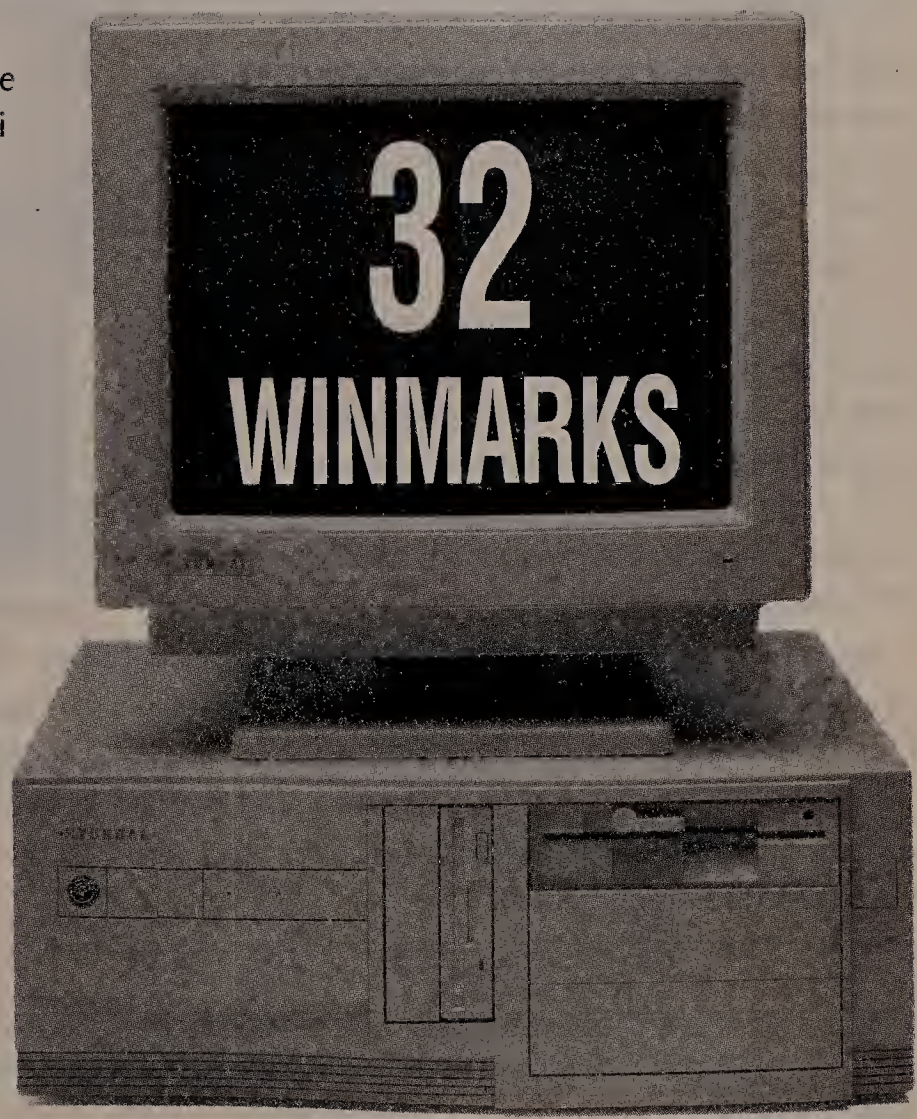
- 120MB 19ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs, (2.88MB-ready FDD interface)
- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt and swivel base
- 2S/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 expansion slots, including 1 VESA local bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front keylock, 2 level password
- MS DOS 5.0 and MS Windows 3.1



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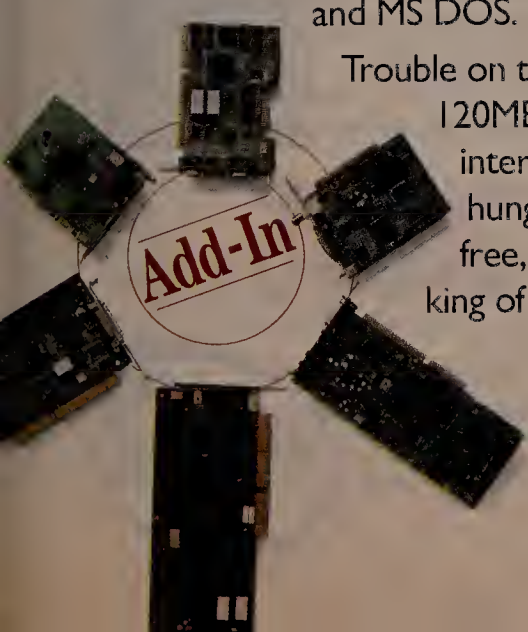
Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we're fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.



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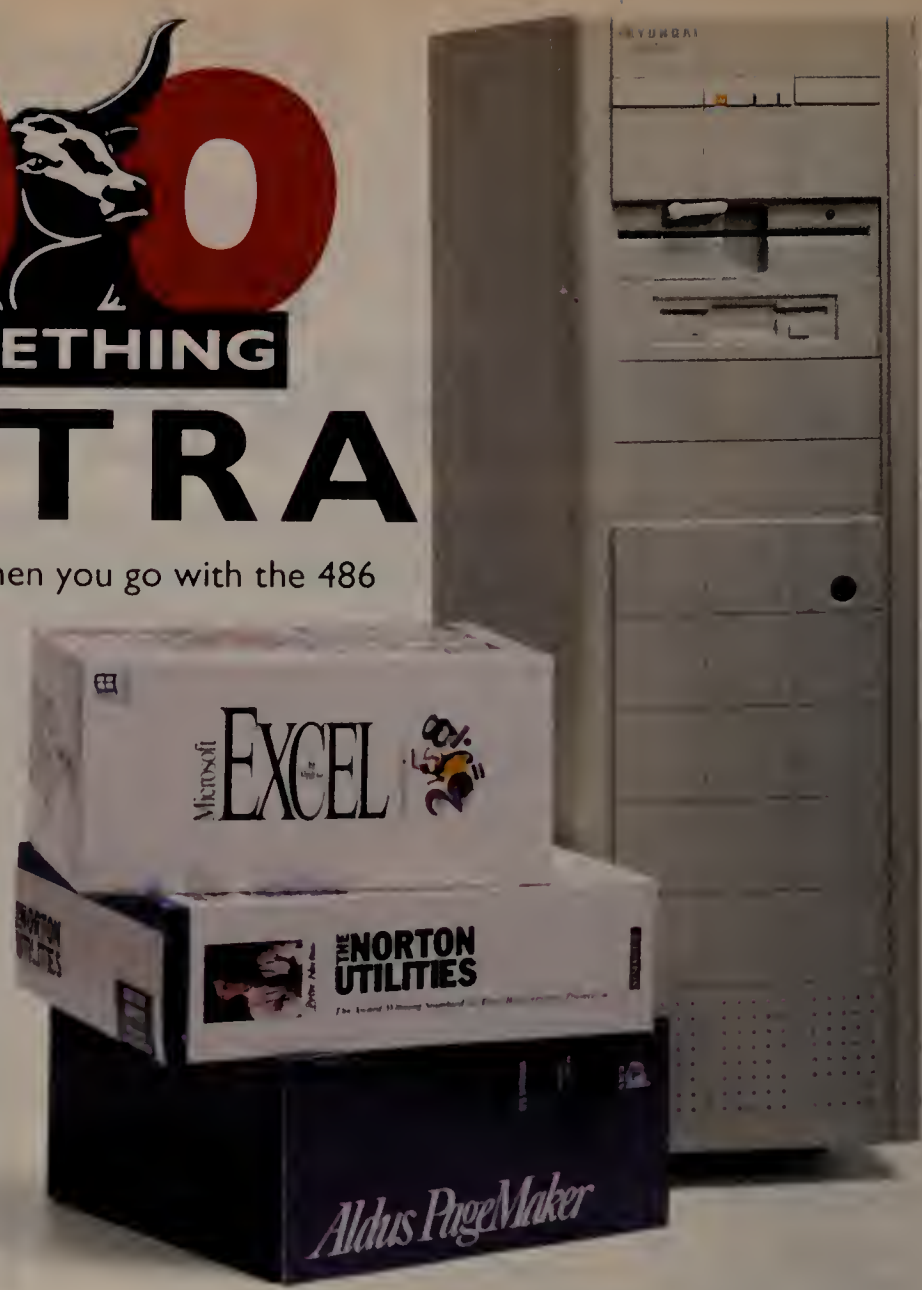

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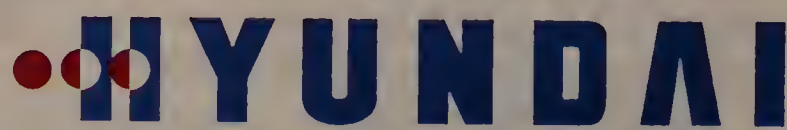

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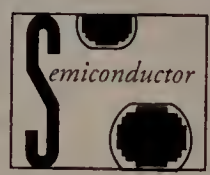

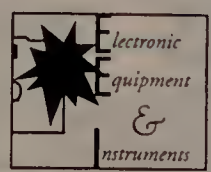

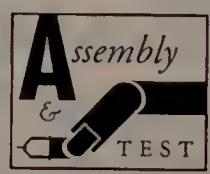

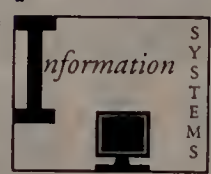

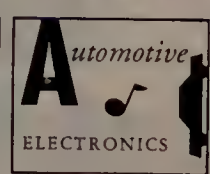

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Circle 106 on reader service card

Navigators Tell You Where to Go . . . and How to Get There

I got to the Highway 13 turnoff in Lukachukai, Arizona, to find two things: The Chuska Mountains stood between me and Red Rock, and lucky Highway 13 is no highway. I understood why *Automap for Windows* had advised me to drive 100 miles around the Chuskas.

Still, I'm nothing if not bad at taking direction, so I turned my gutless Chevy Cavalier onto the rocky dirt road, splashed across a muddy creek, and chugged up and over the 8000-foot-high Chuskas. Sorry 'bout that, Hertz.

As it turned out, Red Rock wasn't worth the gas. But the $100 *Automap for Windows* proved its mettle time and again over the 2000 miles that my son and I wandered around the Southwest. It beat the hell out of my AAA maps when it came to accurately predicting distance, travel time, and the fastest route from, say, Chinle to Chama.

I got turned on to navigational software by friends in sales and other on-the-road jobs who have been snatching up city-side counterparts like *PC Maps* (with a cool DOS GUI) and Zagat-Axxis's new *Windows*-based *CityGuide*. If you lived in L.A., you would too.

Either program will print a little map to help you slash the shortest path through the smog to any address. *CityGuide* adds detailed info on a long list of local hotels and restaurants so you know which L.A. watering hole to mill around in until 10 p.m., when we get our daily half-hour break in traffic.

Just playing around with *PC Maps*, I found a new back route to work (with only five neighborhood zigzags and the fording of one unimproved part of Mulholland Drive). The New York *CityGuide* helped me pinpoint this Brazilian restaurant in Manhattan that I've been raving about for two years. The most I ever remember of names and addresses is, "This place off 6th near the Time/Life building." Actually, it's the Cabana Carioca at 123 West 45th Street. (Try the Brazilian national stew.)

Each *PC Maps* or *CityGuide* map costs about $100. Better brush off a big spot on your hard disk for each citybase. If you have a CD-ROM drive, DeLorme Mapping will sell you its $169 *Street Atlas USA* with every city street and country byway in the United States. You don't get restaurant and hotel info. But hey, they had to compress 5 gigabytes of data just to squeeze all the back roads onto a *Windowed* CD ROM—likely to be the future medium for all such products.

One day soon we'll all drive around with PDAs tuned to paging or cellular frequencies, downloading up-to-the-minute traffic reports factored into instantly displayed best-route scenarios. San Franciscans already have the first part, thanks to the $199 Way to Go pocket pager. Way to Go Corporation has computer operators staked out at the operations center for San Francisco helicopter and car-phone traffic reports. For $15 a month, subscribers get a constant feed on road conditions. Coming soon to a booming metropolis near you.

We in L.A. make do with gazillion-dollar road signs laughably titled "Freeway Condition." On the rare occasions that their LEDs blink to life, they scrupulously avoid announcing the 20-car pileup on the North Holly until you've been stuck for a half hour. As if nature hadn't sufficiently blessed us with smog and sharpshooters.

I'm expecting a rescue from electronic mapmakers, not the government. I impatiently await the day when these products merge and I can get best-route-in-town data with multimedia featurettes on sights, eateries, and hotels for those long road trips. I have yet to meet the tour book that can give me the feel of a place before I've wasted a hundred miles or two getting there.

And I could have used a little help before I hit Gallup, New Mexico. As it was, I had to find out the hard way that just because Ronald Reagan once slept at the "historic" El Rancho Motel doesn't mean the place has local color. To paraphrase Gertrude Stein, "There's *really* no there there."

By Mike Hogan

WHAT TO WATCH

"We are the world:" Dell's DellWare mail-order catalog (800/392-3355) offers competitive prices and free shipping on 650 products, from third-party peripherals to software titles—everything you ever wanted to buy, but didn't want to drive to Radio Shack to find . . . . Backatcha: Radio Shack has a new Tandy Factory Direct program to sell custom-configured computers mail order (through local Radio Shacks) . . . . Canon Computer Systems is breaking into PC sales by bundling its Bubble Jet printers—the $349 BJ-10ex portable or new $400 BJ-20 desktop—with either its $1700 Innova 486SX-25 desktop, $3300 passive-color 486SX-25 notebook, or $1700 386SX-25 note for $150 to $200 less than printer and computer sold separately . . . . Using a patented electronic membrane as a pressure sensor, Interlink was able to make its PortaPoint the handiest, cheapest notebook mouse to date—1.8 by 2.6 by 0.5 inches and $79 direct . . . . Yes, it's cryin' time again: You're gonna need the 1992 HeadStart edition of TurboTax (under $50) to find what last-minute shelter you can before the December 31 curtain falls . . . . The cellular future is Compaq's $800 SpeedPAQ 144 14,400/9600-baud fax-modem with phone jack.

Move up to bigger, brighter windows.

Gaze into our windows and you'll see our high-resolution 15″ MultiSync® 4FG™ and 17″ MultiSync 5FG monitors* offer you spectacular views. These monitors are ideal for display of windowing environments because they both feature a large active display area with FullScan™ capability for bright, sharp, flicker-free edge-to-edge images. Both are compatible with MS-DOS based systems and the Macintosh® II and Quadra™ family systems.

➡ And now if you buy a MultiSync 4FG or 5FG by December 31, 1992, we'll give you a MultiSync monitor lens. Free. ($79 value for the 4FG/$119 value for the 5FG.) The

MVP — MultiSync 5FG monitor

PC World Product of the Year 1991 — MultiSync 4FG monitor

★★★★★ MultiSync 4FG monitor — MacUser Magazine

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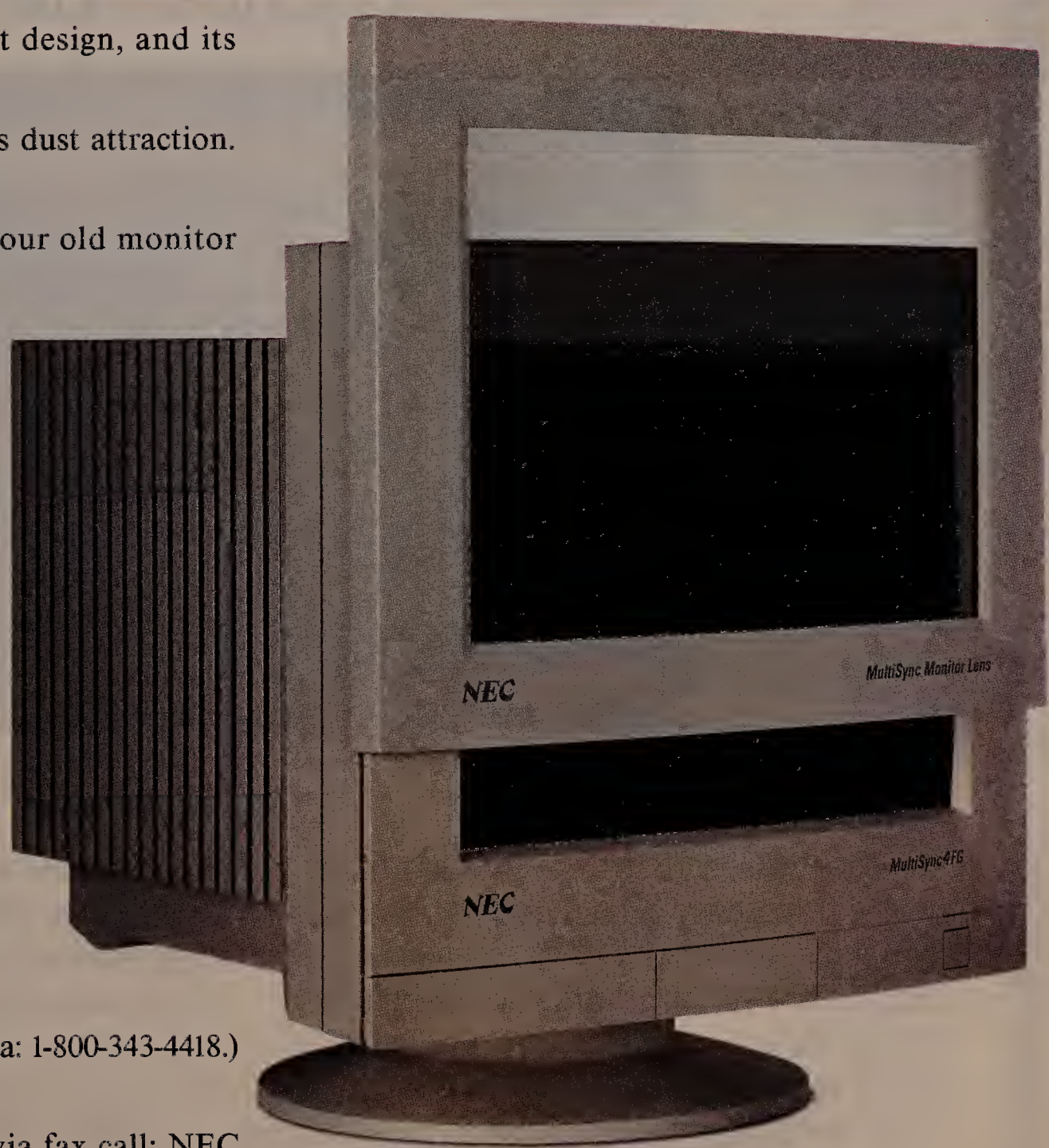
monitor lens provides the perfect balance of contrast and brightness for use in poor ambient lighting conditions such as near windows and under bright fluorescent lighting. It features high-quality OCLI HEA® glass, it integrates perfectly with our cabinet design, and its anti-static coating prevents dust attraction.

And get a free window shade.

➡ So pull the plug on your old monitor and upgrade to an NEC MultiSync FG. Once you look into our windows, you'll want to toss your old monitor out the window. For more information call: 1-800-NEC-INFO. (In Canada: 1-800-343-4418.) For promotional details via fax call: NEC FastFacts™ 1-800-366-0476. Request # 7777.

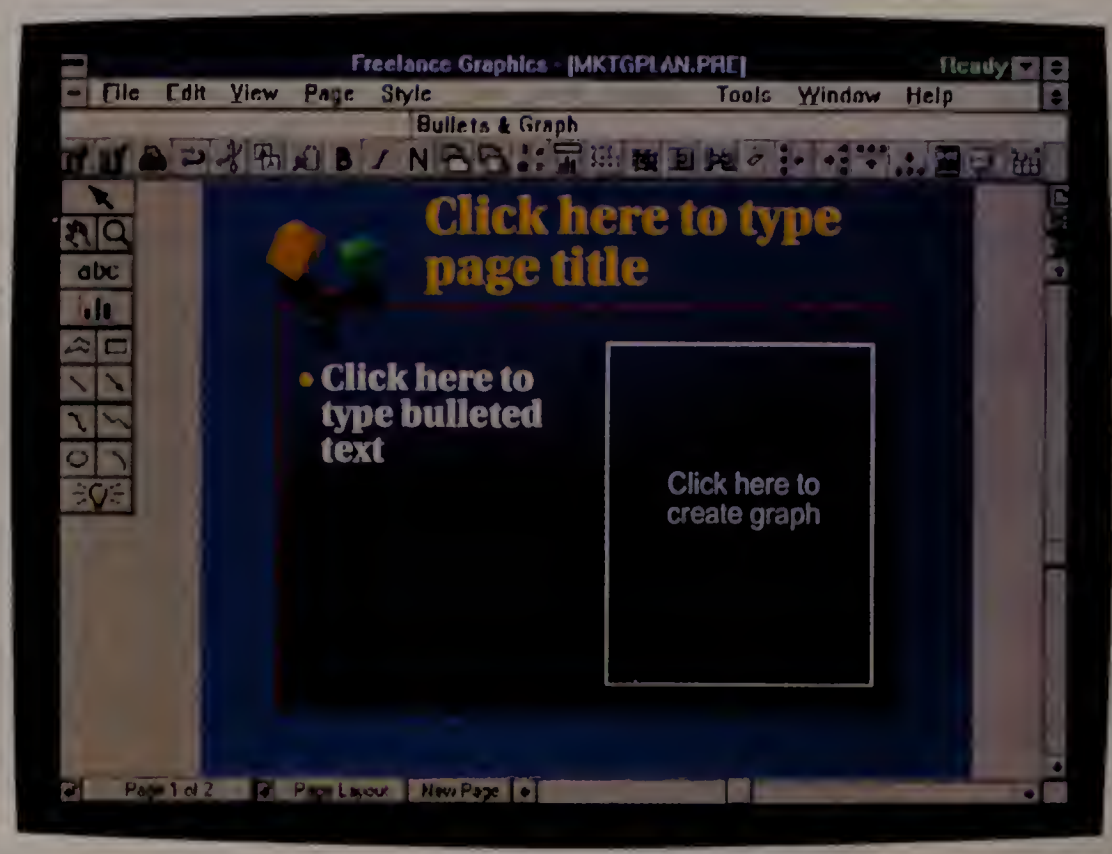


Because ⬆ is the way you want to go. NEC

*15" and 17" CRTs yield 13.8" and 15.6" active display areas.

Circle 188 on reader service card

You won't find an easier way to create a presentation.



Freelance Graphics is so fast and easy that PC Computing *says, "If you can click a mouse, you can create stunning presentations with this package." (11/91)*

It's true. There simply isn't a better way to create a presentation than with Freelance Graphics™ for Windows.™ Its unique SmartMasters™ automatically manage the design for you. Just select the look, follow the on-screen prompts and fill in the blanks with text and graphics. It's that simple.

So simple, in fact, that in 1992 Freelance Graphics has managed to win every major award in its category, including *InfoWorld's* comparative review (score: 8.1) *PC Magazine's* Editor's Choice, *PC Week's* Graphics Shootout and *Computer Reseller News'* Editor's Choice.

What's more, a recent study conducte by the Usability Sciences Corporation four

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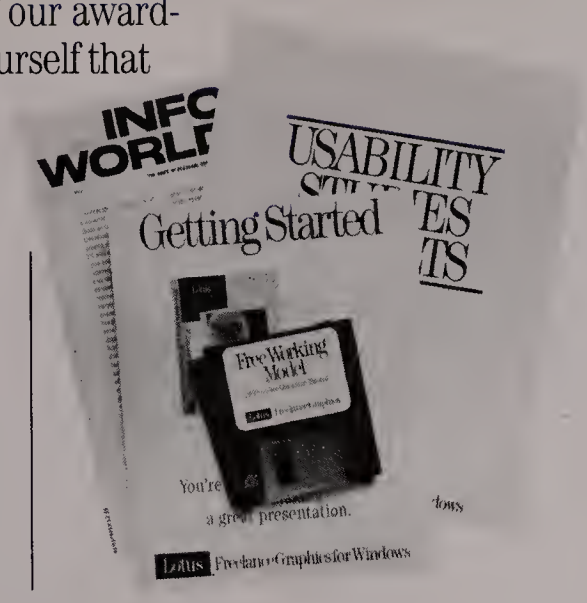
Order your FREE Working Model, a trial version of our award-winning Freelance Graphics for Windows. Prove to yourself that there's simply no faster, easier way to create great presentations. Just complete and mail this card or call 1-800-872-3387, ext. 7150. Offer expires 1/31/93.



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Company: _____

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City: _____ State: _____ Zip: _____

Daytime Phone: ( ) _____

Are you a 1-2-3 user? ☐ Yes ☐ No

My disk format is: ☐ 3½" ☐ 5¼" Do you currently own a graphics package? ☐ Yes ☐ No

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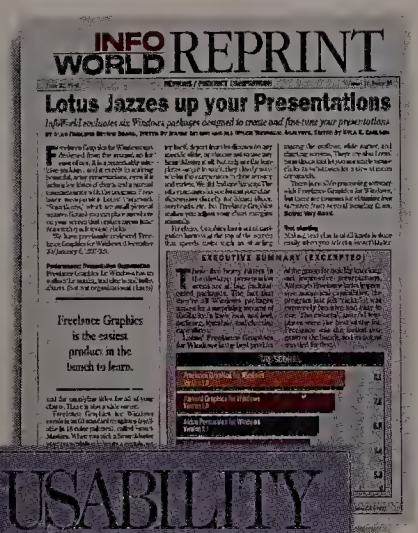
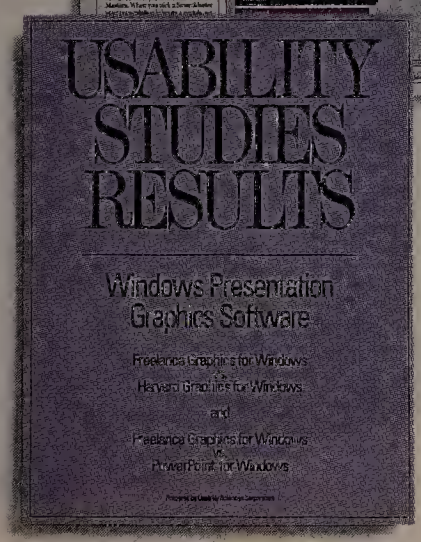
Or better evidence to prove it.



In 1992, Freelance Graphics for Windows has won every major award in its category.



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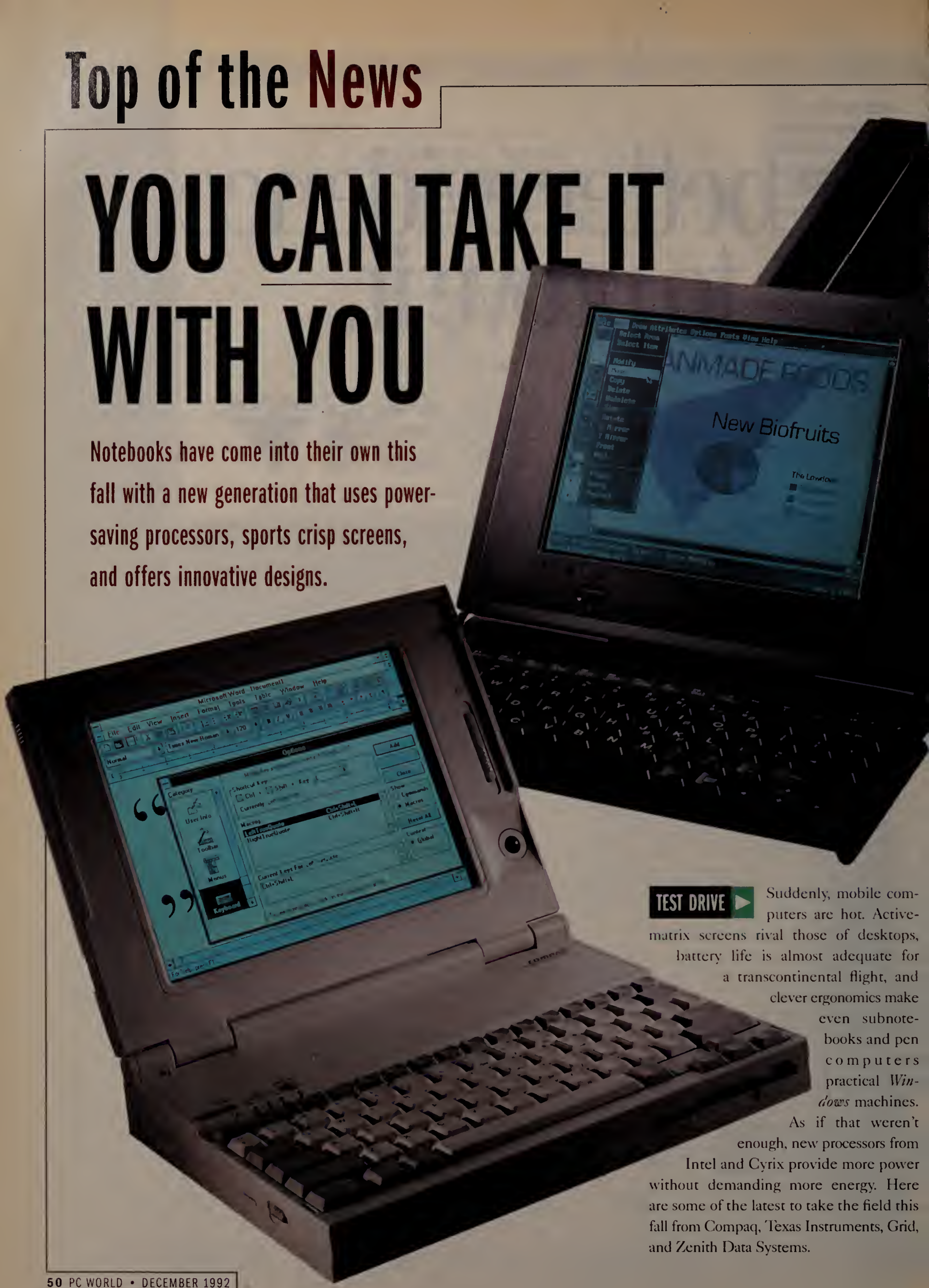
YOU CAN TAKE IT WITH YOU

Notebooks have come into their own this fall with a new generation that uses power-saving processors, sports crisp screens, and offers innovative designs.



TEST DRIVE Suddenly, mobile computers are hot. Active-matrix screens rival those of desktops, battery life is almost adequate for a transcontinental flight, and clever ergonomics make even subnotebooks and pen computers practical *Windows* machines. As if that weren't enough, new processors from Intel and Cyrix provide more power without demanding more energy. Here are some of the latest to take the field this fall from Compaq, Texas Instruments, Grid, and Zenith Data Systems.

Edited by Russell Glitman

Compaq's Lite/25E shines with a bright monochrome display (left), while Grid's unique Convertible transforms from a notebook to a pen tablet.

Compaq's Bright 486 and 386SLs

Looking more like the market shaker of old, Compaq is beefing up its LTE Lite family with a cutting-edge notebook duo that does right by *Windows* on the road. Both notes offer stunning screens: the LTE Lite 4/25C, built around Intel's just-announced low-power-use 486SL-25 processor, sports an active-matrix color display, while the 386SL-25 LTE Lite/25E features a killer monochrome active-matrix display.

The two systems are variations on Compaq's current active-matrix flagship, the Lite/25C, introduced last June. They measure 8.5 by 11 by 2 inches, weigh about 6.5 pounds, and have Compaq's EasyPoint trackball embedded in their LCD frames. Both should do just a little better than the Lite/25C's 3 hours of battery life—even without power management.

Cool Mono a Mano

In a way, the Lite/25E is the most interesting debutant, with its ultra-bright, 9.5-inch monochrome display from Hosiden. The cold-cathode, edge-lit display provides 640 by 480 resolution with 16 shades ranging from bright white to deep, rich black. Applications will jump off the screen. At about $1000 cheaper list than the Lite 4/25C, the 25/E may be all the machine you need.

The Lite 4/25C, on the other hand, benefits from Compaq's homegrown backlighting and video controller technology. Its 8.4-inch, active-matrix color display from Sharp offers super-VGA color at a resolution of 640 by 480—technically equivalent but visually superior to standard SVGA desktop CRTs.

Additionally, the Lite 4/25C's 25-MHz 486SL marks a new era in notebooks. A fundamentally different architecture, the 486SL marries SL power management to the core logic of a 486DX. On board you get the DX's 8K cache, math coprocessor, RISC integer core, memory burst-mode operation, 32-bit memory controller, and ISA bus controller. As a result, the Lite 4/25C is twice as fast as a 386SL-based notebook at the same clock speed and four times faster at floating-point computations than systems with external math coprocessors.

More Punch per Watt

But these notes have more than speed. The 3.3-volt 486SL system draws only three-fourths the power of systems using the 5-volt 386SL chip. Despite offering greater processing power and active-matrix color, the Lite 4/25C still squeezes its nickel metal-hydride batteries just a little longer than the 3 hours of the 386SL-based Lite/25C and Lite/25E.

Although neither the Lite 4/25C nor the Lite/25E includes industry-standard PCM-

News Monitor

GATES TARGETS NOVELL: ***LAN Manager*** **did little more than nudge Novell NetWare off a sliver of the networking market, so Microsoft is "hitting 'em low" with *Windows for Workgroups*. Although Microsoft's entry may pose the greatest threat to Artisoft, whose *Lantastic* put peer-to-peer nets on the map, executive statements at a recent strategy briefing left no doubt that Microsoft's prime target is the only company to have successfully competed with it in system software—Novell.**

Introduced in late October, *WFW* includes both local and remote file and printer sharing, group scheduling, and messaging (see the Test Drive in this month's News). Microsoft expects *WFW* to outsell the single-user version of *Windows* eventually.

Michael Kwatinetz, analyst at Sanford C. Bernstein, sees *WFW* as part of Microsoft's larger strategy to pull common application services into the operating environment, enticing more OEMs to bundle *Windows* and instantly convert PC buyers to Microsoft's application suite. Over time, look for just about any service—from copying to cable television—to be *Windowed*.

WORDPERFECT FOR WINDOWS 5.2: WordPerfect's upgrade offers productivity-boosting tools, including an enhanced button bar, easy-access macros, and quick file searching. Version 5.2 adds eight button bars to WordPerfect's collection of Icon-based tools, plus the ability to swap and customize button bars. You also get new macros, accessible from a pulldown menu. The

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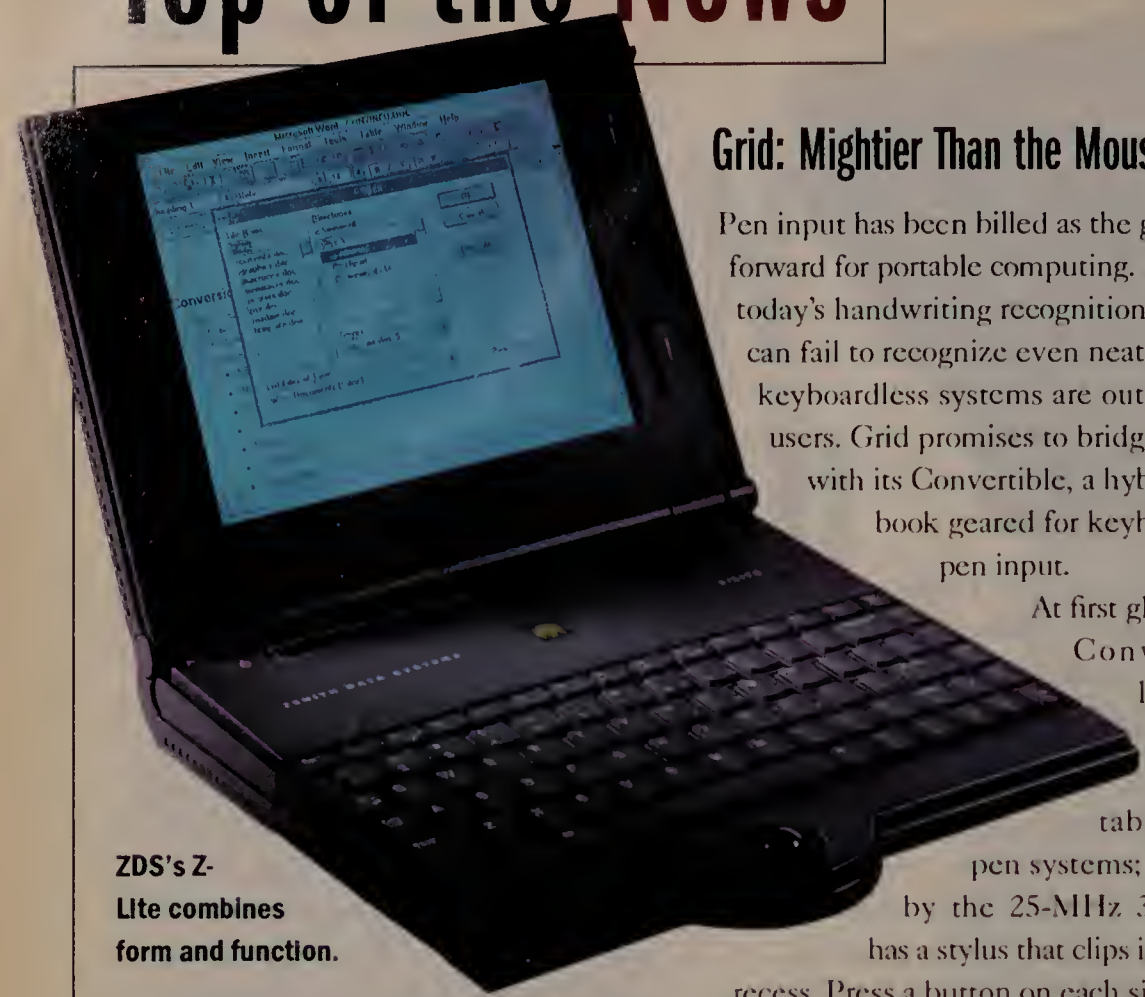


ZDS's Z-Lite combines form and function.

CIA expansion slots, both are equipped with a Compaq-designed Enhanced Option Slot for LAN adapters and fax-modems. And since both start at 4MB of RAM upgradable to 20MB on the motherboard, memory upgrades should be no problem. And the Lite 4/25C also offers a new 209MB hard-drive option.

Neither the 486SL-based Lite 4/25C nor the Lite/25E is the fulfillment of the next notebook generation, but either one will give you a good start on tomorrow.

Grid: Mightier Than the Mouse

Pen input has been billed as the great leap forward for portable computing. But since today's handwriting recognition software can fail to recognize even neat printing, keyboardless systems are out for most users. Grid promises to bridge the gap with its Convertible, a hybrid notebook geared for keyboard and pen input.

At first glance, the Convertible looks like one of Grid's tablet-style pen systems; powered by the 25-MHz 386SL, it has a stylus that clips into a side recess. Press a button on each side of the slim 11.5-by-9.3-by-1.5-inch chassis, and the screen slides up and back to reveal a full-size keyboard.

The rigid magnesium case of the 5.5-pound unit is light. A 125MB hard disk, 2MB of RAM (expandable to 8MB), an external super-VGA monitor connector, and a PCMCIA 2.0 card slot are standard. An external 3.5-inch 1.44MB floppy drive is included; a 14,400-bps internal fax-modem is optional. Battery life is rated at 2 hours. The VGA 9.5-inch diagonal backlit LCD display locks in only one upright position.

But tight spaces are precisely where the Convertible excels. You can hold the computer like a clipboard to check your E-mail in a phone booth or quickly annotate and forward a fax. And you can raise the screen without interrupting work in progress.

Grid expects street price to be under $3000. For a well-designed system that gives you the benefits of pen input and screen navigation and the traditional security and speed of keyboard input, put the top down for a ride with the Convertible.

ZDS's Delightful Z-Lite Subnote

Zenith Data Systems is sending a clear message to portable computer users: It's time to lighten up. And with the 3.9-pound Z-Lite 320L, ZDS delivers a *Windows*-capable, 386SL subnotebook that may convince many they are right. Especially when you consider its compact $1995 list price.

Like recent subnotebook offerings from Dell and Gateway, the ZDS Z-Lite forsakes a built-in floppy drive. What the system does include is a standard 60MB hard drive, 2MB of on-board RAM expandable to 6MB, and a pair of Type 2 PCMCIA slots. The Z-Lite has a backlit 8.5-inch VGA LCD screen, which is surprisingly large for a system this small, and it also has a detachable, front-mounted trackball and an

Compaq LTE Lite 4/25C, Lite/25E

Winning combination of speed, innovative display.

Key Features

- **25-MHz 4/25C 486SL offers twice the processing at three-fourths the power drain**
- **Lite/25E's bright active-matrix monochrome display offers 16 shades at 640 by 480**

Availability: Immediate

Pricing: Lite 4/25C about $4500, Lite/25E about $3500

Compaq Computer Corp.
800/345-1518
Reader service no. 818

TravelMate 4000 WinDX2/50, WinDX2/40 Color, WinSX/25 Color, WinSLC

Two monochrome and two color models.

Key Features

- **Automatically loads Windows**
- **7-pound travel weight**

Availability: Immediate for WinDX2/50, WinSLC; January for WinDX2/40 Color, WinSX/25 Color

Pricing: WinDX2/50 $3899, WinDX2/40 Color $4499, WinSX/25 Color $3699, WinSLC $1999

Texas Instruments
800/527-3500
Reader service no.819

Grid Convertible

Hybrid pen/notebook computer.

Key Features

- **Screen flips up to reveal keyboard**
- **386SL-25 processor**

Availability: Immediate

Pricing: under $3000 (street)

Grid Systems
800/222-4743,
817/491-5200
Reader service no. 820

Z-Lite 320L

Wedge-shaped 386SL brings Windows to the subnotebook class with a unique lightweight design.

Key Features

- **Two PCMCIA slots**
- **3.9 pounds**
- **8.5-inch VGA screen**

Availability: Immediate

Pricing: $1995

Zenith Data Systems
800/553-0331,
800/427-7211 (fax)
Reader service no. 821

optional, somewhat cumbersome 1.44MB floppy drive that connects to a port on the unit's left side.

The 320L is based on the power-saving version of a 3.3-volt Intel 386SL processor running at 20 MHz. Its BIOS is compatible with the Advanced Power Management spec to provide up to 6 hours of nonstop operation from a lightweight nickel metal-hydride battery, despite a high-contrast, backlit LCD display. Power management selections are easy to make from a series of menus. In addition, users can quickly toggle CPU speed with a single keystroke.

The Z-Lite's petite form packs a number of convenience features. One of the best is an LCD status bar that indicates current power source, disk activity, and system status and displays a battery charge gauge.

TI Adds Power and Color

Texas Instruments has added four notebooks to its TravelMate family, offering a mix of CPUs and LCD screens.

Speed demons will appreciate the TravelMate 4000WinDX2/50, one of the first notebooks to feature Intel's two-speed 486DX2-50 chip. Users concerned more with price than power may prefer the TravelMate WinSLC, an entry-level note with the 486SLC chip, a 386/486 hybrid that TI licensed from Cyrix. Two color notebooks, one with the dual-speed 486DX2-40 processor, the other with a 386SX-25, arrived too late to preview.

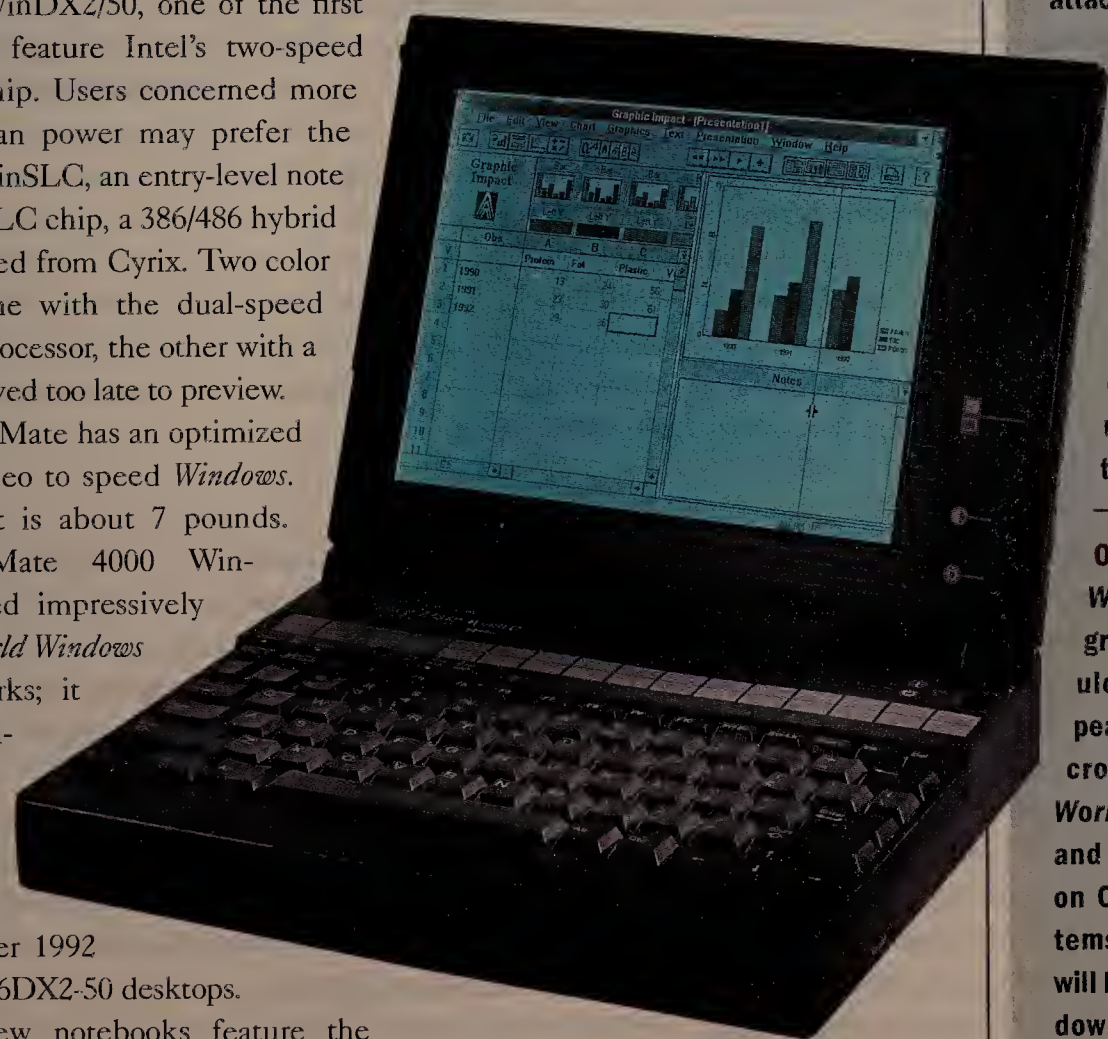
Each TravelMate has an optimized BIOS and video to speed *Windows*. Travel weight is about 7 pounds. The TravelMate 4000 WinDX2/50 scored impressively on the *PC World Windows 3.0* benchmarks; it would have finished among the top ten in *Windows* performance in our October 1992 roundup of 486DX2-50 desktops.

All four new notebooks feature the thoughtful design enhancements of the TravelMate 4000 series, including an advanced version of TI's Battery Pro software that lets you adjust power management features from a *Windows* menu.

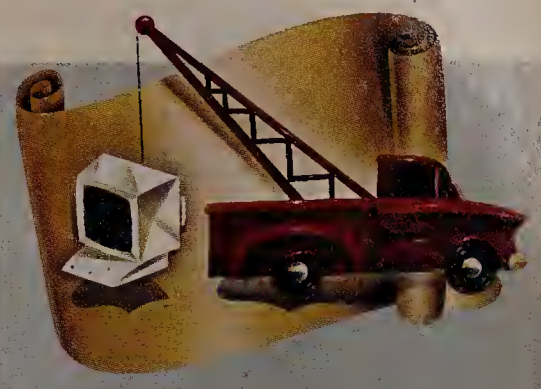
An accurate "gas gauge" utility shows how much battery life is left. Battery life ranges from 3 to 5 hours, depending on usage, TI claims. And the WinDX2/40 and WinSX/25 color models can bring some splash to your presentations by displaying up to 256 colors on a 9.4-inch, passive-matrix LCD screen.

TI's TravelMates may not be the cheapest notes on the block, but they're certainly among the best designed. The WinDX2/50 costs $3899 and includes 8MB of RAM (expandable to 20MB) and a 200MB hard drive. The WinDX2/40 Color, which is available in the same configuration as the WinDX2/50, costs $4499. The WinSX/25 Color comes with 4MB of RAM (expandable to 20MB) and a 120MB hard drive and costs $3699. The WinSLC costs $1999 and includes 2MB of RAM (expandable to 6MB) and a 60MB hard drive.

—Jeff Bertolucci, Michael Desmond, Mike Hogan, Scott Spanbauer



Texas Instruments uses a Cyrix 486SLC processor to power its TravelMate Win/SLC.



News Monitor

(continued from page 51)

QuickFinder builds an index of your files—including those on network drives—and lets you rapidly search them. Version 5.2 throws in an integrated version of Reference Software's *Grammatik* grammar checker, *Adobe Type Manager 2.0*, and filters for *Microsoft Word for Windows 2.0* files. Users of *WordPerfect for Windows* and those who purchased the DOS version after April 1, 1991, can upgrade to version 5.2 for $39.95; upgrades for all other WordPerfect users cost $99.

DELL CATALOG: Dell Computer is attacking the software and peripherals retail market with its DellWare direct-mail catalog. Teaming up with distributor Merisel, Dell is positioning itself between direct-response houses, such as Tiger Software, and superstore chains, such as CompUSA. Nine times a year, over 700,000 full-color catalogs featuring 650 products will be mailed to Dell's customers and prospects.

OFFICE 4.0: The next version of *WordPerfect Office* will include integrated E-mail, calendar, and scheduler applications. The product appears to go head-to-head against Microsoft's upcoming *Windows for Workgroups* but is available for DOS and *Windows* and will eventually run on OS/2, UNIX, and VAX/VMS systems. The DOS version of *Office 4.0* will be a graphical interface with pull-down menus, mouse support, and

(continued on page 55)

DAN PICASSO

PC Introductions Reach Dizzying Pace

Midland Mutual's Jerry Whetnall: Hype surrounding the quickening pace of product introductions makes planning difficult.

As price wars roil the PC market and vendors struggle to keep their products from sinking into the undifferentiated morass of commodities, many manufacturers have introduced new models or product lines almost quarterly in an attempt to claim a unique market position.

One noteworthy example is once-staid IBM, which in a monthlong barrage last fall launched several product lines. That onslaught followed low-cost product line introductions from Compaq and Dell.

"We PC manufacturers are churning product faster than before," agrees Dan Sheppard, director of product marketing at AST Research. But, he says, "We're always adding extra features, extra value, to products."

In effect, computer makers are taking a leaf from the Japanese consumer electronics industry. While prices on camcorders have dropped some, for instance, the Japanese continue to add more features to them.

Users see both pros and cons in the abundance of PCs and decreasing product life cycles. Shorter product cycles mean more hours and dollars spent on product evaluation, staff training, and system management. But they also provide more frequent opportunities to take advantage of the latest technology, including new processors and LAN-ready PCs, for a competitive edge. "Our use cycle has speeded up," says Daniel Willis, senior analyst for 3M Corporation in St. Paul, Minnesota, who buys primarily IBM Micro Channel machines. "We need computers that are network ready, with high resolution and strong video capability. I'm for the more the merrier."

Jerry Whetnall, assistant vice president of corporate systems for Midland Mutual, runs an all-Compaq shop. Whetnall prefers the steady-stream approach the industry took only a year ago because it helped him plan as his company downsized from mainframes and minis to networked PCs. He dislikes the hype that surrounds today's new products: "I don't like the fact that I order machines when they are announced and then I have to wait for months for delivery. Sometimes they announce things too soon to get one-up on the competition."

The quickening product pace most threatens Asian suppliers. The speed with which the market is moving has made it difficult for companies in Japan or Taiwan to respond as quickly as they must to keep up with U.S.-based firms. South Korea–based Hyundai recognized that handicap and restructured its business to grant its U.S. arm near-autonomy under the direction of president and CEO Ed Thomas, formerly with direct vendor CompuAdd. In mid-October, Thomas brought out more than 50 new systems developed under his tenure in a company record of six months.

—Kathleen Wiegner

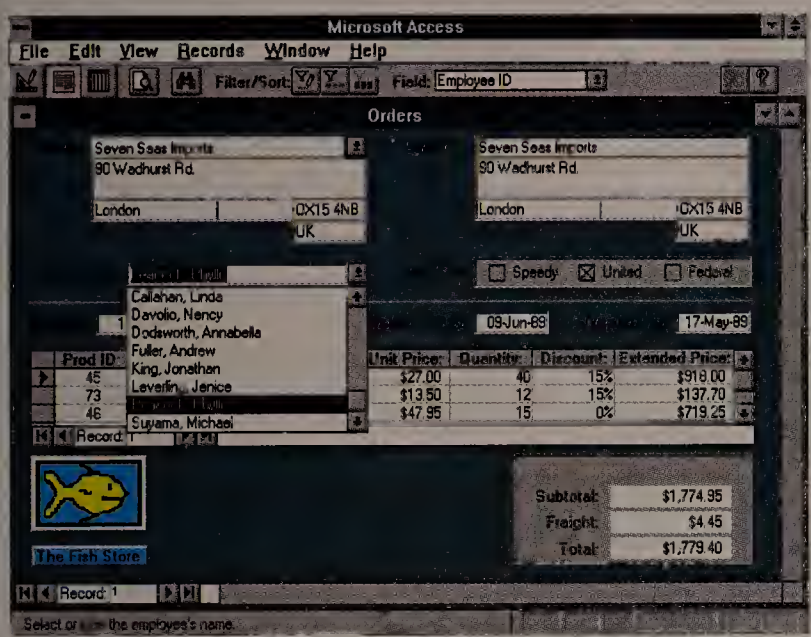
Meca Product Blitz Boosts Sales: Now is the time to optimize your tax position, and Meca Software is ready to help with the earliest release ever of its *Headstart* editions of TaxCut for *Windows* and DOS.

The products cost less than $50 on the street and include communications software for filing tax forms electronically. Also enhanced is the interview process by which the program offers tax planning advice.

Developers at the Fairfield, Connecticut, firm have also outdone themselves with an update of the company's flagship product, *Managing Your Money*. Version 9.0 of this personal and small-business financial management product lists for $79.95. It offers a *Windows*-like look and feel, including pull-down menus, and has tax planning and estimating tools, mortgage refinancing and loan amortization calculations, and retirement planning modules. New investment management features include links to QuoteLink, which automatically updates your investment portfolio, and Market Watch, which monitors prices at user-defined intervals.

Sales have been booming at Meca since a dramatic price reduction of *MYM* in May, a thrust into direct marketing, and the acquisition of Great American Software and its *One-Write Plus* accounting line. Revenue in the most recent quarter, which ended September 30, was more than $5 million, far exceeding the $2 million in sales recorded by the company for the same quarter a year ago.

Microsoft's Accessible Database



Entering data into forms is easy, thanks to list box and check box fields, defined on this two-table order-entry form.

TEST DRIVE In 1985, Ansa Software released *Paradox*, a relational database that was actually usable by mere mortals (Ansa was later purchased by Borland). That same year, Microsoft began work on its own relational database program. Now, seven years later, Microsoft is ready to release the application *Access*, which takes the *Paradox* paradox—that a database can be both powerful and easy to use—to the next logical step. As beta tester Steve Shay, senior analyst at Hallmark Cards' information technology group in Kansas City, Missouri, puts it, "Microsoft has done an outstanding job in creating an interface that allows serious developers full control of the product's capabilities while shielding this complexity from the novice."

Access's most exciting and innovative feature is the way it links your queries, data, and answer tables. With the typical PC database, you enter and edit data using tables, but when you need to query the database, a static, unlinked answer table is generated. *Access* replaces the static answer table with a dynamic, updatable virtual table called the *dynaset*. Once created, a dynaset is virtually indistinguishable from a table. Forms, reports, and even other dynasets can be built on a dynaset. And dynaset data is always hot-linked back to the original tables. Thus, when you discover an incorrect value while reviewing the results of a query, you can fix it right there—in the query—with *Access* automatically reproducing the change back to the underlying tables.

The idea behind dynasets is not novel; the concept of updatable views has been part of relational database theory for decades. But until now, no major vendor was able to bring this desired feature to users.

On-line help is standard in PC databases, but *Access* advances the state of the art with Cue Cards—tutorials that coach you step by step through tricky procedures. Unlike conventional tutorials, Cue Cards stay on screen as you perform the task. For example, Cue Cards could help you design a query or write a macro. Like other Microsoft programs, *Access* includes Wizards—templates to help start a job, such as creating a form or report.

As befits Microsoft, *Access* supports Object Linking and Embedding (OLE) fields, which can be used to store a graph, a picture, or a whole spreadsheet. The program also supports the definition of validation rules and intertable relationships, including referential integrity. This advanced feature ensures, for example, that a customer number referenced in the orders table really exists in the customer table. Surprisingly, *Access* doesn't offer data entry masks, a common feature in many databases that is useful for entering fields such as telephone and Social Security numbers.

The query-by-example (QBE) module departs significantly from the *Paradox* standard. This may seem a disadvantage, but *Access*'s QBE is simply better because tables are linked visually, with a line connecting related fields. And if relationships between two tables have already been set up, *Access* draws the line automatically.

News Monitor

(continued from page 53)

resizable windows. Built over a common application and database engine, *Office* will offer such features as global calendaring, rules-based message management, work flow automation, and electronic forms integration. *Office 4.0* should ship early in 1993.

ACCESS PERSPECTIVE: The new *Access* database is the keystone of Microsoft's building-block strategy for both single-user and work group applications. PC World's Test Drive finds it a robust and accessible environment for building database applications by combining objects—filling the gaping hole in Microsoft's application suite.

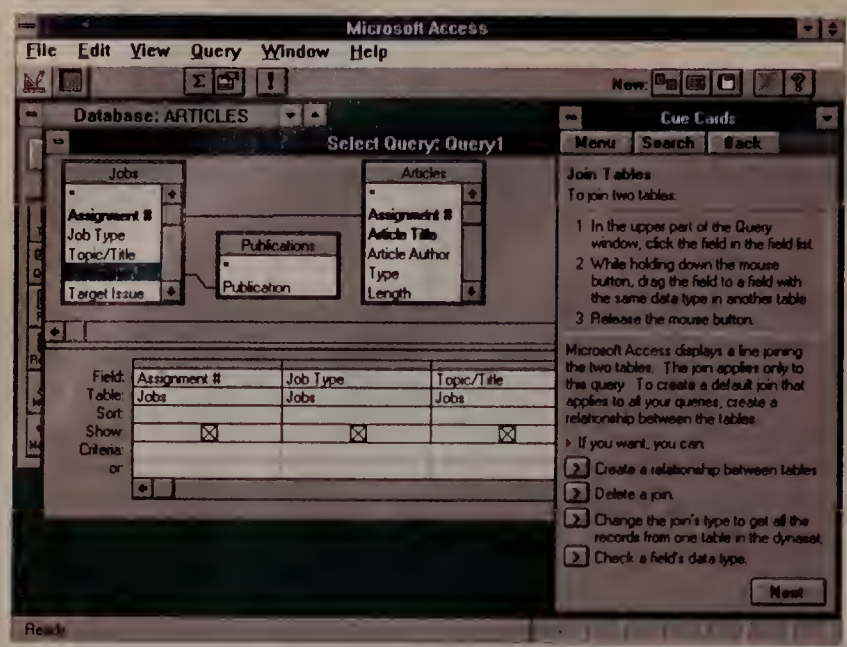
More than a traditional transactional database, *Access* also provides a replicating data engine à la Lotus's *Notes*, upon which new types of applications will be fashioned, says Microsoft executive vice president Steve Ballmer.

Tapping the similarly object-oriented Visual Basic and the as-yet-unreleased version 2.0 of Microsoft's Object Linking and Embedding (OLE) specification, users will one day reach across *Microsoft Mail 3.0* to retrieve remote data without leaving their environment of choice—*Word, Excel,* or a work group applet such as *Schedule +*.

Users of non-database applications may be Microsoft's best prospect, observes *Soft-Letter* publisher Jeffrey Tarter, because those already invested in a database are a very tough sell.

—Michael Desmond, Jim Forbes, Russell Glitman, Mike Hogan, Daniel Tynan

DAN PICASSO



Cue Cards (on the right) are great for learning how to join tables in Microsoft Access's query-by-example module.

Continued from page 55

Form design is pretty much a point-and-click affair, with support for the usual *Windows* objects such as radio buttons, check boxes, and list boxes. Macros can be attached to various "events," so that, for example, one macro can run when a field is reached with the tab key and another when the value is changed. *Access* also has a flexible band-oriented report writer that makes two passes through the data so that reports can include on page 1 a percentage of a total that appears on page 10.

Access's powerful programming language is based loosely on Microsoft's *Visual Basic*. As powerful as this language is, you may never need to learn it, since many operations that require programming in other packages—for example, defining data entry rules—can be accomplished without a single line of code in *Access*. Those who do venture into programming will appreciate the inclusion of a debugger, although it does not support watch variables.

The program imports and exports data in a variety of formats, including *dBASE*, *Paradox*, *Excel*, and *FoxPro*. Unfortunately, unlike in Microrim's *R:BASE*, user-defined validation rules are not respected during imports. *Access*'s ability to read and write *dBASE*, *Paradox*, *Btrieve*, and SQL database files directly makes it a good candidate as a corporate front-end system.

Database novices will likely find *Access* easier to learn than *Paradox for Windows*, thanks to its Cue Cards, Wizards, and overall simpler interface. Developers, however, may prefer *PFW*'s richer, more object-oriented programming language and powerful developers' tools. While *Access*'s performance does not approach *FoxPro*'s speed, it's nonetheless respectable, and the shipping version will probably compare with that of other *Windows* databases.

Like most first releases, *Access* has a few rough edges. There's no facility for printing macros or a database's structure. Nor can you call up a list of field or table names to paste into macros and programming code as in *Excel*. Still, *Access* is an extraordinary new *Windows* database program that breaks new ground in both power and ease of use. Delivery may have taken seven years, but it looks as if the time was well spent.

—Paul Litwin

Microsoft Access 1.0

WINDOWS **This relational database manager breaks new ground in both power and ease of use.**

Key Features

- **Queries, data, and answer tables are linked**
- **OLE support**
- **On-line help and Wizards**

Availability

Immediate

Pricing

$695

Microsoft Corp.
800/426-9400, 206/883-8101 (fax)
Reader service no. 822

Megahertz's PCMCIA fax-modem card

PCMCIA Cards Arrive:

A collection of credit card–size network adapters, fax-modems, and other peripherals, all with street prices near $500, are coming to market this fall to fulfill the promise of the PCMCIA slots that vendors have built into the latest mobile computers.

These peripherals conform to version 2.0 of the PC Memory Card International Association (PCMCIA) format. Version 2.0 supports internal modems, LAN adapters, drive controllers, and other input/output devices that typically plug into the I/O bus of a desktop PC.

Over the past year, PC vendors have built PCMCIA 2.0 card slots into their mobile PCs, in many cases forsaking a floppy drive in favor of a PCMCIA slot. But cards to fill those slots have been slow to reach the market—until now.

IBM recently introduced a series of PCMCIA cards for connecting portable PCs to ethernet and token ring networks as well as IBM 3270 mainframes. Prices range from $375 for the ethernet card to $845 for token ring.

Intel Corporation and other OEM peripheral manufacturers such as Data Race of San Antonio are now selling PCMCIA cards to computer manufacturers and other retailers. Intel's new fax-modem and LAN adapter cards should carry street prices of around $500, according to the company.

Other PCMCIA card manufacturers include Megahertz Corporation of Salt Lake City with a new line of fax-modems, Xircom of Calabasas, California, with an ethernet adapter, and Proxim of Mountain View, California, with a wireless LAN card. Expect to pay $500 or less for these cards, too.

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Eo Communicator: Lord of the Roads

For executives who spend a lot of time away from their desks and need to stay in constant contact, Eo Incorporated has developed a computer with an optional cellular phone that offers instant communications on the road. The Personal Communicators 440 and 880, which target mobile professionals and executives, perform intelligent filtering and management of E-mail, fax, data, and voice messages.

Both machines are based on the AT&T Hobbit RISC processor, a power-saving, high-performance chip comparable to the 486SL. The 440 runs at 20 MHz to process 15 MIPS, and the 880 runs at 30 MHz for a processing speed of 20 MIPS.

The systems run Go Corporation's PenPoint operating system and ship with a half-dozen applications.

The tablets have keyboard, parallel, and serial ports; a phone jack; a microphone; and a speaker. Eo also provides an optional cellular phone and cradle that attaches to the top of each unit. The 440 is 2.2 pounds and measures just over 7 inches long and 10.8 inches deep. The 880 is 9 inches long and 13 inches deep and weighs 4 pounds. Both are about 1 inch thick and should have at least 4 hours of battery life, according to Dyer.

The 440's reflective VGA screen is 4 by 6 inches. The 880 is backlit, and its screen is 5.7 by 7.6 inches. It comes with VGA and SCSI II ports, and two PCMCIA slots or room for a 1.8-inch hard drive with up to 64MB. The 440 has one PCMCIA slot and an optional internal 20MB hard drive, Hewlett-Packard's matchbook-size Kitty Hawk.

Due in second quarter 1993, the 440 will cost $2000 to $3000. The 880, which includes a 14.4-kbps modem and 9600-kbps send and receive fax (optional on the 440), will be under $4000. The cellular phone will cost about another $1000.

—Russell Glitman

The Eo Personal Communicator: wireless E-mail, fax, and phone.

The Curtain Rises on Video for Windows

Windows users, who have lacked an equivalent to the Mac's QuickTime desktop video standard, are about to receive an invitation to a screen debut when Microsoft ships *Video for Windows*. This $199 collection of basic video capture and editing tools comes with a CD-ROM sample of movie clips that use the Audio/Video Interleave (AVI) format, Microsoft's new video creation specification for *Windows*. *Video for Windows* has bit-map, audio, and palette editors for fine-tuning movie elements and can convert QuickTime movies to the AVI format. You don't need *Video for Windows* to play AVI movies, however—Microsoft plans to post an AVI driver and Media Player miniapp on its product-download BBS and CompuServe.

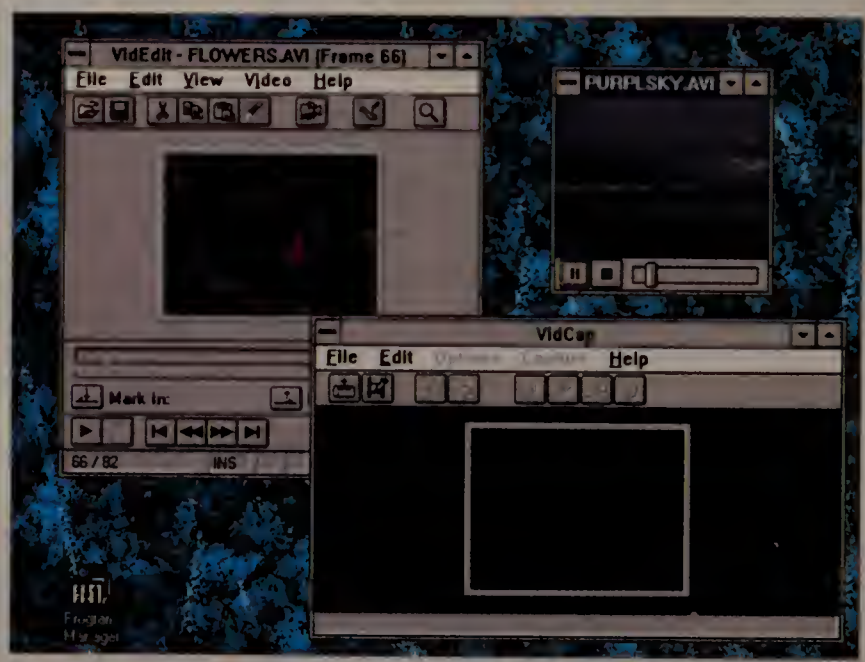
I Spy Avi

AVI allows the capture, editing, compression, and replay of 8-, 16-, and 24-bit digital video and CD-quality audio under *Windows* at resolutions as high as 640 by 480 at 30 frames per second, for lifelike recording and playback. AVI also supports external data compression/decompression (codec) software and hardware. In addition to its proprietary codec, *Video for Windows* will ship with Intel's Indeo codec software, a subset of its DVI technology.

AVI's highest resolutions will require hardware-assisted compression, such as that provided by the combination of Intel's ActionMedia II board and the Indeo codec, and/or frame-accurate video sources, such as a laserdisc player.

Most users who don't have special hardware will be able to capture video only in a 160-by-120-pixel window at 15 frames per second, which results in somewhat jerky playback. AVI synchronizes sound and video and drops frames as necessary from AVI movies to keep images and sound in sync on slower systems.

—Scott Spanbauer



Microsoft brings video to the desktop with Video for Windows, a video capture and editing program due this fall.

There's a lot of talk about speeding up Windows.

But only one video.

Epson's® new Progression™ PC makes Windows™ race so fast (up to ten times faster), you have to see it to believe it.

So we created a video to let you do just that.

For a free video that dramatically proves how you can race through Windows without costly and complicated accelerator cards, call **1-800-BUY EPSON.**

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Windows for Workgroups: A LAN for the User

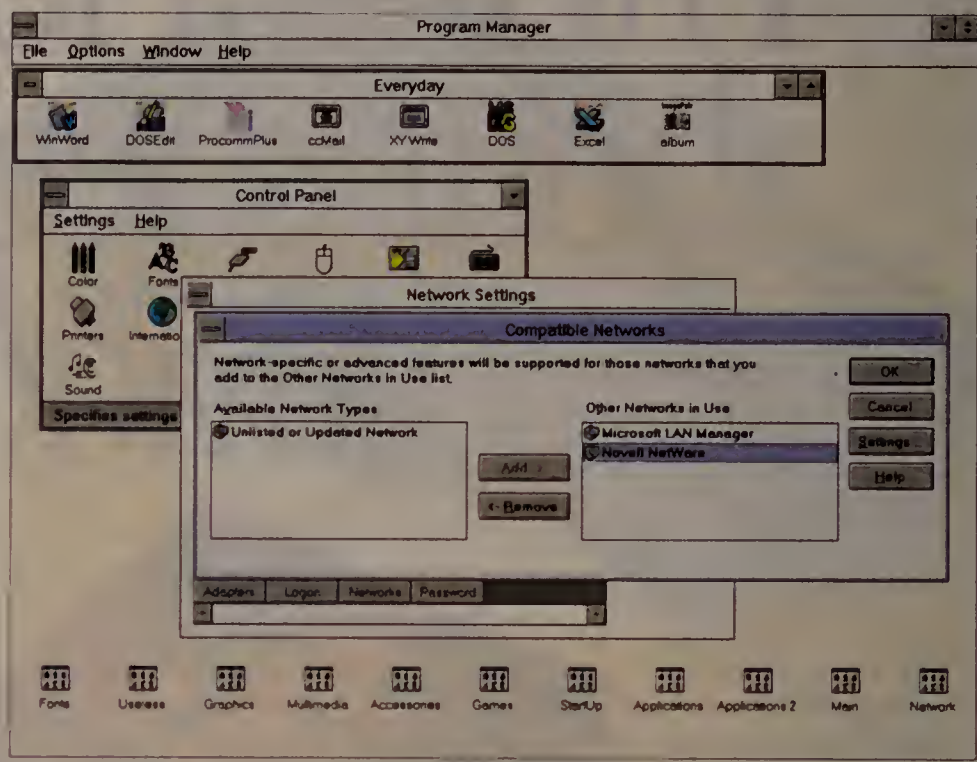
TEST DRIVE

Don't let the network world intimidate you. With *Windows for Workgroups 3.1*, Microsoft delivers a new version of *Windows 3.1* that promises to be the closest thing yet to painless connectivity. It integrates peer-to-peer networking, E-mail, and group scheduling.

Microsoft claims *WFW* will configure itself automatically during installation to work with most network boards so you can set up your own departmental network. In our lab, it worked fine—*WFW* recognized our network boards and in some cases even detected how their jumpers were set. In other cases, it made an educated guess and gave clear instructions for troubleshooting.

Sharing files and printers is equally easy, thanks to network-aware versions of *Windows'* File Manager and Print Manager utilities. To share a directory, just select it and click the Share icon in *WFW*'s File Manager's tool bar. A dialog box pops up in which you set passwords for full and read-only access.

Password protection is usually an irritating way to protect network resources, because you may have to remember a separate password for every remote drive you use. Microsoft's clever workaround: You can set your copy of *WFW* to "memorize" each password the first time you use it, so the only password you need to remember is the one that unlocks the password memory bank.



Microsoft's Windows for Workgroups gives the power of setting up and configuring LANs to users, who can now create ad hoc networks.

Peaceful Coexistence

WFW coexists happily with other networks. It can access not only other workstations running *WFW* but NetWare and *LAN Manager*, and it will eventually be able to access Windows NT servers as well. DOS workstations can access a *WFW* net and E-mail system through Microsoft's *Workgroup Connection* but can't share their resources with the network.

WFW eliminates LAN RAM-cram for most users by running network drivers in extended memory—only one 4K driver needs to go in conventional memory. Another set of drivers (120K) is provided for use on 286s, systems with only 2MB of RAM, or any system running *Windows* in standard mode. Like DOS workstations, such systems can access the network and E-mail but can't share.

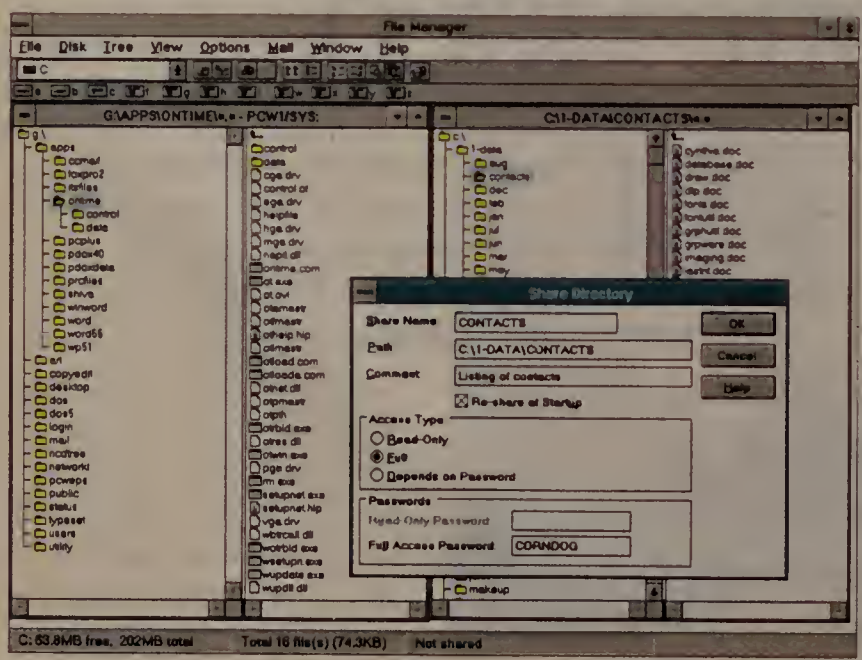
Several unique features give *WFW* an edge over other *Windows*-aware peer-to-peer LANs. The Network applet in the Control Panel has a slider that lets you adjust how much of your computer's time is spent serving remote users.

The Clipbook is a shareable version of the clipboard. Paste text, a graphic, or an OLE object into the Clipbook, and it's available to anyone on the network (with full access or read only, as for drives). Change a Clipbook object, and it's updated everywhere on the net.

WFW includes streamlined versions of *Microsoft Mail 3.0* and *Schedule+*, Microsoft's group scheduler.

The two-station starter kit has all the hardware and software you need. Software-only packs are available, either bundled with *Windows 3.1* or as an upgrade to *Windows 3.1* or *3.0*.

—Robert Lauriston



With the peer-to-peer Windows for Workgroups you can determine who has access to your files and what they can do with them.

Windows for Workgroups 3.1

WINDOWS **Microsoft's peer-to-peer NOS makes Windows networking easy.**

Key Features

- **Seamless integration with NetWare and Windows NT**
- **E-mail**
- **Group scheduler**
- **Shared clipboard**

Availability

Immediate

Pricing

Windows for Workgroups Addon for Windows 3.1 $100, with Ethernet board $275, five-user pack $400

Microsoft Corp. 800/426-9400, 206/936-7329 (fax)

Reader service no. 816

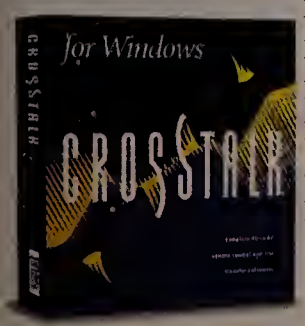
The Heavyweight Champion Of Windows Comm Software Just Became Even More Of A Knockout.

The first round was no contest. Long before we won the *PC Magazine* Editors' Choice Award, Crosstalk® for Windows was the undisputed title holder. *Software Digest* called it the "best of the graphical communications packages." *InfoWorld* named it "Product of the Year." And it won the *Windows Magazine* Readers' Choice Award.

But for all its power, we knew it had the potential to pack an even bigger wallop.

New Crosstalk For Windows 2.0. A Technical Knockout.

PC World says it "jumps far ahead of the last version" and "advances the state of the art in modem software." And you can see the difference the minute you start it up. The interface is more functional, more convenient and just downright fun to use. A new QuickBar™ tool menu turns common tasks like downloading a file into a simple matter of clicking on an icon. And it follows Windows™ 3.1 interface standards to the letter.

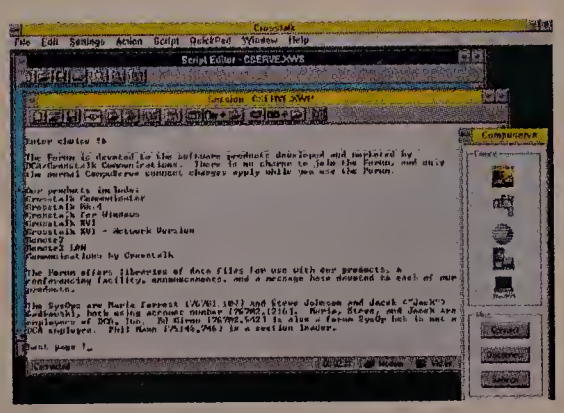


But we didn't just put a new face on an old program. We also taught it a lot of new tricks. For instance, Crosstalk for Windows now includes FTTERM and IND$FILE support for connection to IBM® mainframes, as well as HP® and WYSE® terminal emulation. There's also a text editor built right in. You can edit information and send it out again, without leaving Crosstalk.

We Hit It Right On The Button.

Push a button and run a script, with our new object QuickPad™ feature. Even non-programmers can design custom controls with objects such as buttons, icons and pictures. Then embed a text string or an entire script in each object.

In minutes, you can design a whole new front end for a host system and make it as friendly–and as personalized–as you want. We even include pre-built QuickPads for accessing and navigating the major on-line services.



Windows within Windows: QuickPads float on your screen, ready to run entire scripts at the push of a button.

Now's The Time For You To Get Pumped Up.

You can have multiple comm sessions running at once–working on a VAX® link while you're connected to CompuServe®, for instance. You can remap your keyboard by moving keys on a graphical keyboard layout. Just drag and drop.

> *Crosstalk for Windows sets the performance bar even higher for competitors in the Windows communications market.*
> *—PC World, October 1992*

You can even import dialing directories from the DOS version of Procomm Plus.™ (We want to make everything easy for you, including *switching* to Crosstalk.)

So climb into the ring. Registered users of Crosstalk for Windows and Procomm Plus can upgrade for only $49, by calling our toll-free number.* Go a round or two with Crosstalk for Windows 2.0, and you'll know why it's the winner and still champion. To upgrade or for more information, call

1-800-348-3221, ext. 25C.**

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Another Communications Solution From DCA®

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June 30, 1992
Crosstalk for Windows
Version 1.2.1

1990
Crosstalk for Windows

Circle 62 on reader service card

NetWare 4.0: A Friendlier LAN

NetWare 4.0, the latest addition to Novell's network operating system stable, is targeted mostly at big companies whose networks have outgrown NetWare 3.x's capabilities. This new NOS handles 1000 users per server (version 3.11 manages only 250 users) and integrates all servers on a network into a single global directory, simplifying management of complex installations. Security has also been beefed up: 4.0 allows supervisors or independent auditors to track every aspect of network use, and Novell expects it to meet stringent government security requirements (formal certification is pending).

NetWare 4.0 also makes computing a great deal easier for end users. Thanks to a more versatile directory service, it's no longer necessary to log in to each individual server—log in once and you have access to the whole network. Navigating is now simpler, because the network appears as a single browsable tree, like subdirectories on a hard disk. NetWare 2.x and 3.x servers appear in the tree, although you can access only those servers on which the supervisor has created an account for you.

Document Management

The other major new feature in 4.0 is back-end support for document and image management applications. 4.0's High Capacity Storage System (HCSS) can combine data on different types of drives, such as hard disks, WORM drives, and optical jukeboxes, into a single logical volume. That means users can search on-line and archived files as if they were all on the same drive. To speed searches, HCSS includes "index cards" to describe the contents of a file. For example, you can attach keywords to scanned images. Built-in file compression and decompression reduces storage requirements.

NetWare 4.0 won't be required to use Novell's long-promised server mirroring (SFT Level III). This extra-cost add-on, due in early 1993, offers fault-tolerant protection by providing a fiber-optic dedicated LAN connection between the two servers. If the primary server crashes or shuts down, the backup server takes over automatically. Server mirroring eliminates downtime due to regular maintenance as well as to hardware problems. The linked systems don't need identical hardware—for example, the primary server could be a top-of-the-line, brand-name 486, and the backup an inexpensive 386 generic clone.

Novell plans to continue to upgrade NetWare 3.x and NetWare Lite. The company will also keep selling and supporting NetWare 2.2 but has no current plans for further upgrades to that product.

One of the primary advantages of NetWare 4.0 is its enhanced support for wide area networking—or interconnecting LANs at multiple sites, according to John Noel, principal networking analyst for Dataquest in San Jose, California.

"The earlier versions of NetWare prohibited people from doing this efficiently. With version 4.0, Novell has removed a lot of constraints from connecting [multiple] LANs," Noel says. This capability is greatly assisted by NetWare 4.0's new features like global directory and a "burst mode" that speeds up delivery of data packets over a wide area network.

—Robert Lauriston

The More Users the Merrier

Version	Maximum users per server	Price for maximum number of users
NetWare Lite 1.1	25	$2475
NetWare 2.2	100	$5495
NetWare 3.11	250	$12,495
NetWare 4.0	1000	TBA

Although exact pricing of NetWare 4.0 has yet to be set, analyst John Noel believes upgrades from version 3.11 will cost about $11,500.

Netware 4.0

A more powerful yet easier-to-use version of NetWare with document management and fail-safe options.

Key Features

- **1000 users per server**
- **Global network directory**
- **Document and image management support**
- **Optional server mirroring**

Availability

First quarter 1993

Pricing

To be determined

Novell, Inc.
800/638-9273
Reader service no. 817

Rising Tide of High-Resolution Printers

A new wave of laser printers is reaching the market with resolutions of 600 dpi or better, providing sharper text and smoother images for nearly the same price as 300-dpi printers. About 30 machines are on the market now, including models from Compaq, Lexmark, and Hewlett-Packard, whose LaserJet 4 is likely to make the biggest splash (see "Next-Generation Lasers" in this issue).

Tom Dempsey, senior support engineer for Lockheed Aeronautical Systems in Marietta, Georgia, plans to use the LaserJet IV to integrate text and graphics in huge government proposals. "We hope it will translate into more successful bids," says Dempsey. "A proposal's first impression does carry weight. Higher resolution gives us a better visual product."

As a standard for high-quality office printing, 300 dpi may be washed up. "You're going to get 600 dpi for the price of 300," says Ed Pullen, director of printer market research for InfoCorp in Santa Clara, California.

—Daniel Tynan

The best word processor for Windows is by Lotus.

Says who?

'Tis Better to Send Than to Receive

Paul Stackhouse of Kentucky Educational Television in Lexington, Kentucky, has no problems sending faxes from his PC—but receiving them is too slow.

Wander the aisles of your local Egghead or CompUSA this holiday season, and you'll probably spot half a dozen new fax programs next to the word processors and spreadsheets. You'll find packages with sophisticated image editing tools for writing on faxes without first having to print them, built-in scanner support, and optical character recognition (OCR) for converting fax images into editable text.

Some of the newest fax programs come from high-profile vendors such as Intel, ZSoft (which was recently purchased by WordPerfect), Caere Corporation, and Phoenix Technologies, with prices ranging from under $100 to $200.

The boom in fax-modem sales is fueling vendor interest in fax software. Total U.S. shipments of fax modems will top 2.2 million this year—three times 1991's total—and climb to 4.5 million in 1995, predicts BIS Strategic Decisions, a market research firm in Norwell, Massachusetts. *Windows* is the platform of choice for fax software: Millions of copies of the environment have shipped, and its application integration makes sending faxes from within any *Windows* program easy, says BIS analyst Janet Fugazzoto.

The Receive Conundrum

Most PC fax users we spoke with said they're generally pleased with their fax software and hardware, citing the ease of sending computer-generated documents (by redirecting printer output to a fax-modem) as the biggest plus. However, many voiced a common gripe: Receiving faxes is too difficult.

The reasons are varied. Some users complain that receiving a fax can tie up their computers for several minutes as the PC's microprocessor attends to the incoming document. Others dislike leaving their computers on all the time to receive stray faxes that may arrive at odd hours. And many users with only one phone line complain that their fax-modems can't distinguish between voice and fax calls (although some new fax-modems can tell the difference).

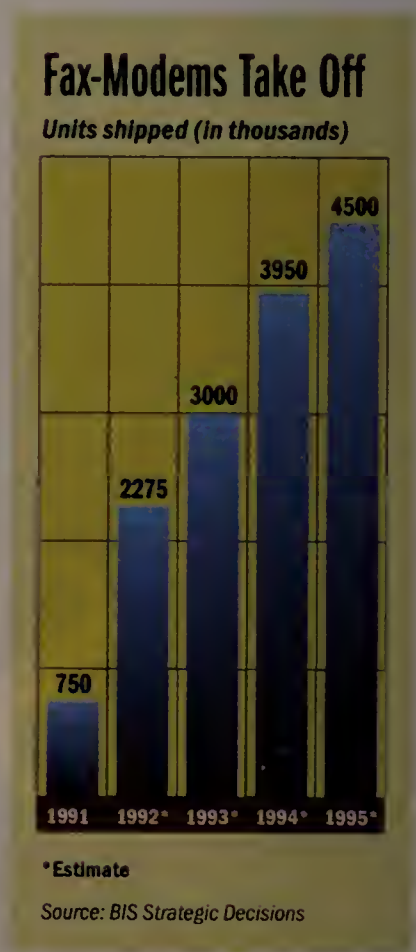
"I don't think a fax-modem can ever live up to its claim to be an adequate way to receive faxes," says Paul Stackhouse, interactive technology manager for Kentucky Educational Television in Lexington, Kentucky. Stackhouse says some faxes he's received transmitted only partially and incoming faxes slow his PC to a crawl: "It's not worth it." Stackhouse uses *WinFax Pro*, which he says works fine for sending faxes. His complaints about receiving faxes were echoed by many users of competing products.

David Payer, a graphic artist in Des Moines, Iowa, reports that PC faxing has made it easier for him to send work samples to out-of-state clients. But he admits that "one problem is that you may get a fax on the spot, and you don't have your computer turned on."

Some LAN-based fax users also report difficulties using a dedicated server to receive faxes. While some of the latest LAN fax software such as Intel's *NetSatisFaxtion 2.0* supports inbound routing, sending faxes to users' workstations typically requires that an administrator read the cover page of each incoming fax and then route the fax to the appropriate user—a time-consuming requirement. "We only implement [LAN-based faxing] for outgoing faxes," says Nancy Raley, director of office information services for Calfarm Insurance Company in Sacramento, California. "For incoming faxes, we might as well just have a plain-paper fax machine."

According to analyst Ken Camarro of Fairfield, Connecticut–based Camarro Research, which recently published a 686-page report on computer-based faxing, recent advances in fax technology may alleviate many users' problems. Users whose PCs take forever to receive faxes may want to improve performance by upgrading to pricier fax-modems (in the $300 to $500 range) that include on-board processors and RAM to receive faxes in the background, such as Intel's SatisFaxtion Modem/400 and Hayes's Optima 144.

Those who don't like to leave



Total U.S. shipments of fax-modems will top 2.2 million this year—three times 1991's total.

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My disk format is: ☐ 3½" ☐ 5¼"

Do you currently own a word processor? ☐ Yes ☐ No

If yes, which one? ☐ Ami Pro ☐ MS Word ☐ WordPerfect ☐ Other

Approximately how many PC's are currently installed at your site? ☐ 1–4 ☐ 5+

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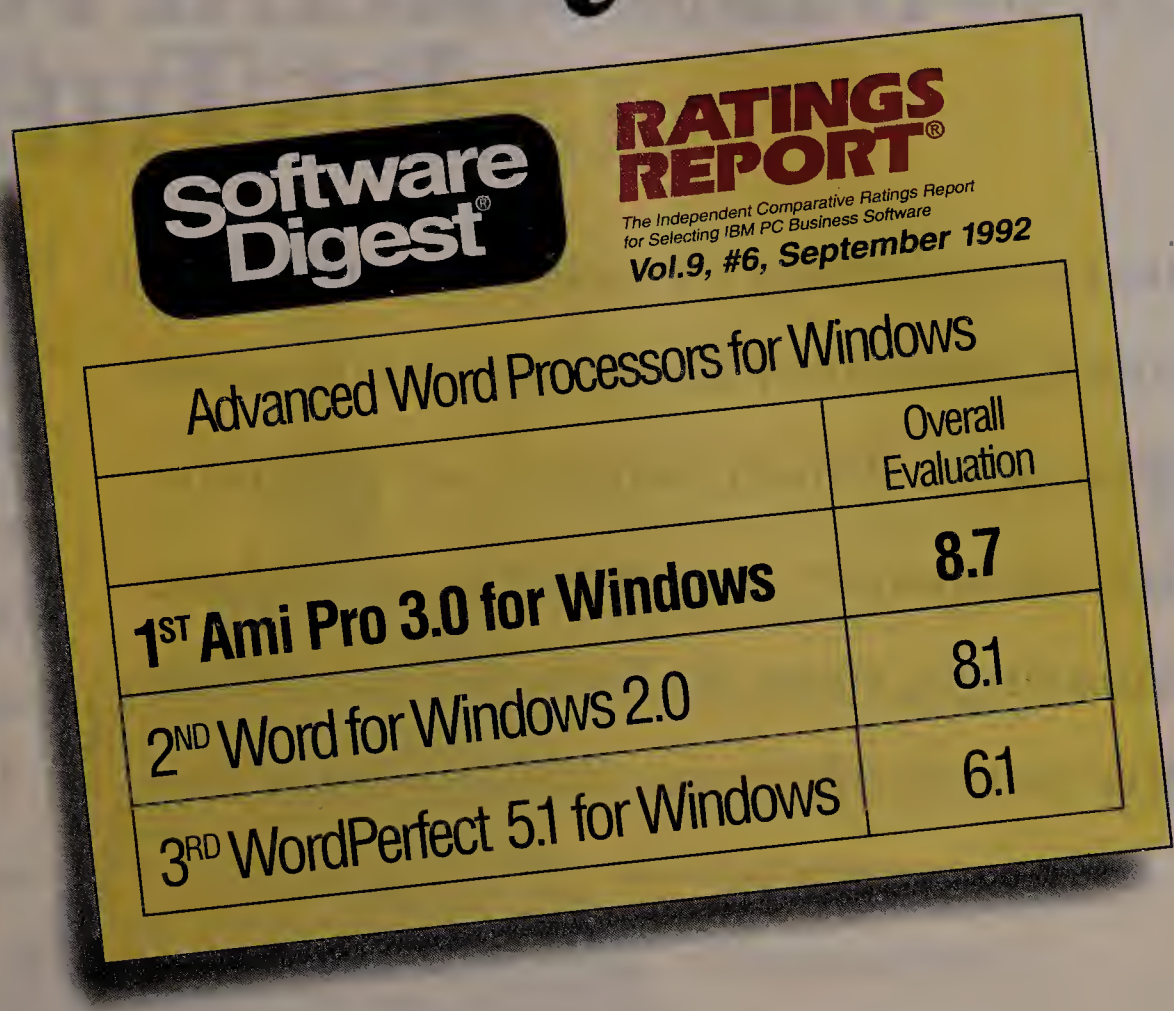

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PC/Computing (8/92)

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Circle 175 on reader service card

SOME COMPANIE
WILLING TO PAY FOR A
IT'S THE ONL

Design. Engineering. Testing. Service. Support. When you think about it, these are what make one computer better than the next. Which makes it all the more surprising that companies are cutting back in these areas. And, amazingly, some do little but stick their name on at the end of somebody else's assembly line.

It would be like buying a car, looking under the hood, and discovering that it was built by a company you'd never heard of from a place you'd have trouble finding on the map.

It makes you wonder about the kind of company that would do it. Why they would make the decision to put their name on a product over which they maintain little control. And why they would then sell it to their customers.

Obviously, at some point during some meeting in some boardroom, the mandate came down:

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Other PC companie do things differently, lik offering substantially lin ited service and suppor for products they appa ently have less confidenc in. Dell has even gone s far as to withdraw thei

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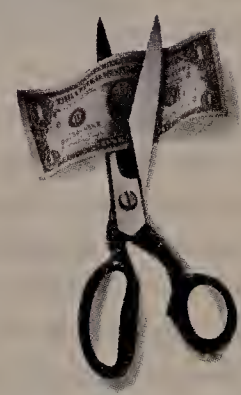
So the choice before you isn't simply between different computers. It's between different computer companies. The kind of companies that are willing to sell out their name to sell you a computer. And a company whose name still stands for everything you want in a computer.

For more information, just call 1-800-345-1518 in the U.S., or 1-800-263-5868 in Canada.



While other companies have been forced to cut corners, at Compaq, we've managed to lower our prices without lowering our standards.

Some ideas are better than others. Unlike a lot of today's clones, the new COMPAQ PCs are all designed, engineered and tested by Compaq.

COMPAQ

Circle 47 on reader service card

Continued from page 64

their PCs on all the time might want to check out Acer America's new AcerPac 150 and Acros 380 PCs. These multimedia systems feature Start Smart, a phone-activated suspend/resume utility that wakes up the PC when a call comes in.

Server Technology in Santa Clara, California, sells a $169 phone-activated, power-control unit called Remote Power On/Off that turns on your PC when the phone rings. And with distinctive ring service from your phone company and a fax-modem like Zoom Telephonics' $394 VFP, one of several Zoom modems that can distinguish the different cadences on a phone line, you can create a virtual switchboard that routes incoming voice, fax, and data calls. National Semiconductor says its $279 Ty IN 2000 modem can distinguish between incoming calls even if you don't have distinctive ring service.

Fax Software Gets Fancy

Vendors haven't solved all the problems of PC-based faxing, but they've taken great strides in improving their software. The latest retail fax packages, such as *WinFax Pro 3.0* from Delrina, *Eclipse Fax* from Eclipse Systems, and *UltraFax* from ZSoft, feature image editing tools that let users mark up incoming faxes without first using OCR to convert the images to text. Users can draw circles, boxes, and lines and type text over their faxes. Other features that are becoming de rigueur include the capability to scan hard copy (provided you have a scanner) directly into your fax application rather than using a separate scanning program, as well as OCR for converting fax copy into text.

Fax hardware and software vendors have a long way to go before using a PC fax is as simple as using the fax machine. But despite its growing pains, we can expect computer-based faxing to expand dramatically during the 1990s. Its potential as an electronic document distribution system greatly outweighs its current shortcomings. Indeed, analyst Camarro predicts that by the middle of the decade, over half of the facsimile addresses in the United States will be computers rather than stand-alone fax machines.

—Jeff Bertolucci

PC Fax: Not Always a Good Connection

Turn-Ons

- Easy to fax computer documents by redirecting printer output to a fax-modem
- Saves paper: you decide which faxes to print
- Inexpensive: fax-modems now sell for under $100
- Sends documents from within *Windows* and DOS applications
- Sends higher-quality faxes than paper-based fax machine

Turn-Offs

- Must leave computer on all the time to receive faxes
- Too slow: ties up computer for several minutes
- Fax-modem answers voice calls
- OCR has problems recognizing text on low-resolution faxes
- Need scanner to import and send hard-copy documents not already stored in PC

Quicken Gets Financial Management Tools

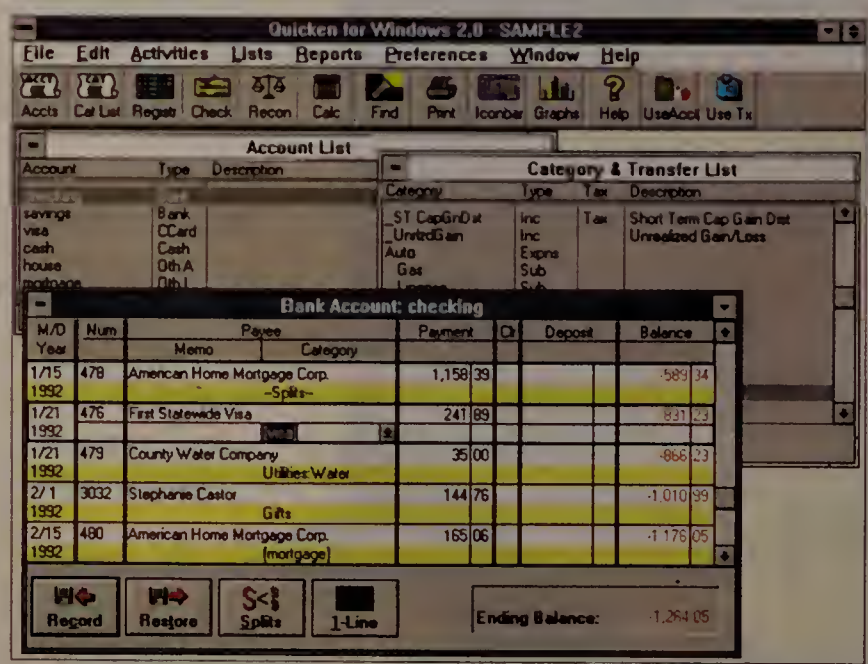
TEST DRIVE

Quicken started out eight years ago as just a snappy comeback to the question, So what am I supposed to do with a home computer, balance my checkbook? In fact, *Quicken*'s intuitive checkbooklike interface made converts of millions, and five generations later, the program has evolved into a financial do-all.

Quicken 6.0 for DOS and its GUI counterpart, *Quicken 2.0 for Windows*, offer better methods for tracking mortgages and investment portfolios and even provide credit card reconciliation for a new *Quicken* Visa card. The twin emphasis is on ease-of-use and new financial management tools—graphs, flexible amortization schedules, and financial calculators.

DOS *Quicken* users will find the *6.0* interface virtually unchanged except for the single-line register option, which displays three times as many transactions as *5.0*. More important, *Quicken 6.0* provides far more hand-holding when you first set up accounts.

Naturally, *Quicken 2.0 for Windows*' interface is far more graphical than the DOS version's. For example, memorized transactions and expense category lists can be accessed from drop-down list boxes right on the appropriate check fields. Alternatively, you can keep those lists, a register, and a couple of accounts open on the desktop simultaneously.



Quicken 2.0 for Windows keeps your check register account list and category/transaction list open simultaneously.

Taking a cue from *Microsoft Money*, both versions sport a new feature, *Quickfill*, that improves upon the already masterful way that *Quicken* reduces repetitive keystrokes in check writing and reporting. As I typed *Dr.* in the payee field of a check, *Quicken* filled out both my check and register with information from a check I had written to Dr. Craig Ford (even though his was not one of my memorized transactions). But as I continued typing *Dr. D*, it switched to the check I had written to Dr. Devoree Prepsky. That's a fast and smart database!

If you really want to cut keystrokes, CheckFree will pay recurring bills with fixed amounts via modem on prearranged dates. But if, like me, you play a monthly guessing game as to whether your pay-

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But before you decide which one to buy, listen to what Jerry Pournelle says in *BYTE Magazine*: "Although QEMM-386 6.0 says that it knows how to make Windows work properly, that isn't true..."

And he's not the only expert who has doubts about QEMM: "a potentially risky procedure," "serious disk performance problems" (*PC Magazine*), "more and more contrived" (*PC/Computing*).

Even the makers of QEMM will tell you (in their *Technical Note #192*) that with QEMM you "may encounter a wide number of situations that can cause errors."

Instead, we suggest you try 386MAX.® Because 386MAX lets you run Windows with unmatched reliability and, as *BYTE* puts it, "seems to work flawlessly." And that can mean avoiding a lot of crashes.

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BYTE PC MAGAZINE EDITORS' CHOICE PC WORLD BEST BUY

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Circle 236 on reader service card

Continued from page 66

check or bills will clear first, you may want to rely upon BillMinder to prompt you for due bills and mail the checks yourself.

A new pop-up calendar and tape calculator help wherever you are in *Quicken*.

Data Entry Chore

Even with these helpmates, data entry is bound to be your number one financial management chore. You'll have to enter at least six months of transactions from your current checking account into *Quicken*'s account register to make the budgeting features meaningful. And you'll probably find yourself tinkering with expense and payment categories forever.

On that score, I never could figure out how to set up an account to debit my individual credit card charges to the proper categories. I still can't. But now, IntelliCharge automatically enters Visa charges into a *Quicken* register with transactions appropriately assigned. Unfortunately, this works only with the Primerica Bank Visa card offered through Intuit, and while there's no annual fee for this card and the interest rate is competitive, you pay $35 a year to download the electronic statement or $55 a year to get a disk delivered. I'm still reconciling my fanfold of other credit card statements by hand.

Take a Snapshot

At report time, *Quicken* helps you put the numbers in perspective with one of 35 preset charts, each suited to a specific financial milestone (much like the new *Microsoft Money 2.0*). For example, a *Quicken* pie chart is best for showing the percentage of your total expenses that each individual expense category represents, while a double-bar chart provides a better picture of how actual spending compares with budget in different categories.

These preset charts can really help with investment reports. You can quickly pull a multiline chart to see how different stock and bond prices are rising and falling over time. Now you download lengthy security price histories from Prodigy, and QuickZoom lets you return to the last report you viewed.

High Finance

Quicken always had a nice little split-transaction feature to amortize home loan payments and assign the appropriate amounts to interest and principal every month. Both new versions also account for variable rate loans, impound accounts, loan prepayments, and balloon payments. You can even do a little financial what-iffing à la Meca's *Managing Your Money*, thanks to financial calculators for loans, mortgage refinancing, present/future-value, retirement, and college planning.

Frankly, some advanced features make my head hurt. But the new *Quicken* smooths the way with context-sensitive help and tutorial "assistants" on the main menu for more complex functions such as amortizing a variable-rate mortgage, exporting tax information, or setting up an investment account.

Those who want to explore *Quicken*'s esoterica should be prepared to invest some time. But thanks to extreme—some might say obsessive—attention to how its customers interact with computers, Intuit has kept *Quicken* as accessible as ever, particularly its core functions.

—Mike Hogan

Quicken 6.0 for DOS, Quicken 2.0 for Windows

Personal finance program becomes a financial duo.

Key Features

- **Automatically categorizes credit card charges**
- **35 preset charts for reports**
- **Helps make investment calculations, loan comparisons, college/retirement plans**
- **Downloads stock price histories from Prodigy**

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Immediate

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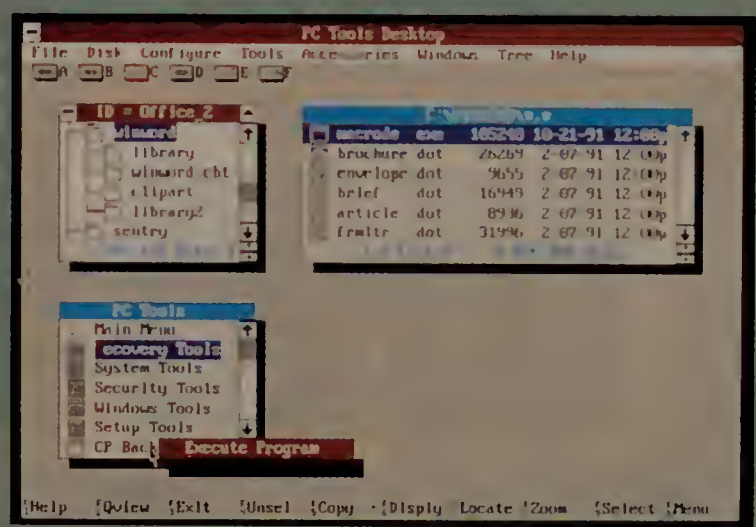
800/624-8742; 415/322-0573; 415/329-2799 (fax)

PC Tools Gets Major Overhaul:

Central Point Software is shipping version 8.0 of its flagship program, *PC Tools*, with an improved interface and some attractive new capabilities. The biggest addition to the program is the task switcher, which is integrated into the central shell program and interface, now called the *PC Tools* Desktop. The task switcher runs up to eight programs and allows you to cut and paste text between them. Also new to the collection is a program that works with all the major memory managers to load device drivers and TSRs into high memory. The Desktop sports some interface improvements, including smoother transitions into the bundled utilities and improved drag-and-drop features.



Central Point's PC Tools 8.0 offers a number of new tools and enhancements for the desktop, including a revamped interface and the integration of the task switcher.

***PC Tools 8.0* also includes upgrades to Central Point's Anti-Virus program, Backup utility, and remote communications program, Commute. Backup supports more tape drives, including SCSI, and has utilities that let you format, retension, and otherwise directly work with your tape. (Unlike in previous *PC Tools* versions, no *Windows* version of Backup is included.) Commute will have faster screen painting.**

The last major upgrade of PC Tools was marred by extensive bugs. The company has promised more thorough testing this time around and a more stable, dependable program.

Central Point Software, 800/445-4208, 503/690-8083 (fax).

Reader service no. 815

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1-2-3 Compatibility

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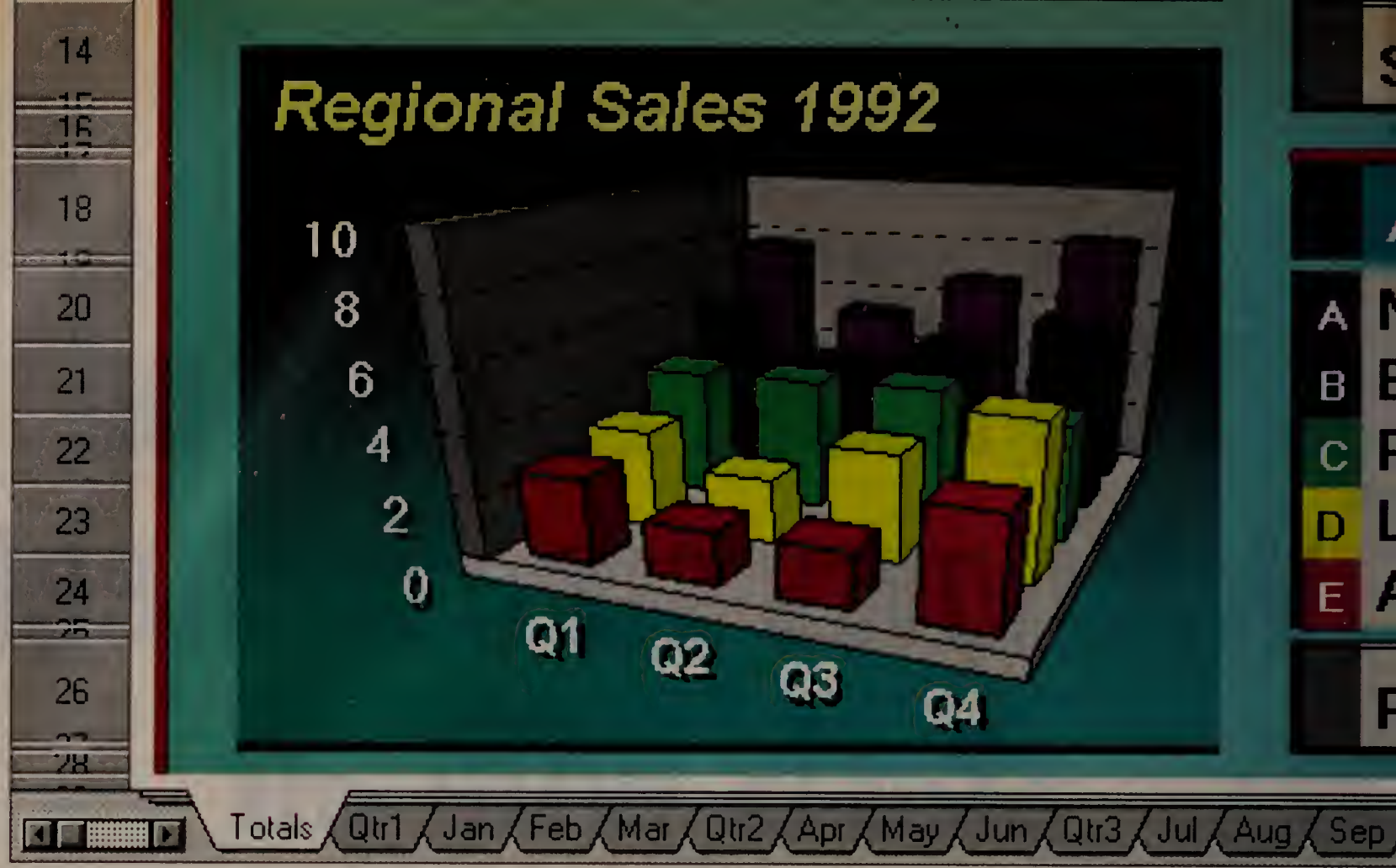

...Spreadsheet

Quattro Pro for Windows *is the most usable spreadsheet ever made. Built with Borland's renowned object-oriented technology, Quattro Pro for Windows* is packed with hot new features you won't find in any other spreadsheet.*

NEW! Spreadsheet Notebooks* with customizable Tabs are nothing less than a revolution in spreadsheet ease of use. Now you can intuitively organize and manage your spreadsheet data.

NEW! Object Inspector™ menus end the hassle of searching through menus. They're simpler than 1-2-3. Just click the *right* mouse button anywhere on the screen to get a list of what you can change and change it right there.

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NEW! SpeedFill™ and **SpeedFormat™** slash setup time by automatically filling in spreadsheet headings and formats.

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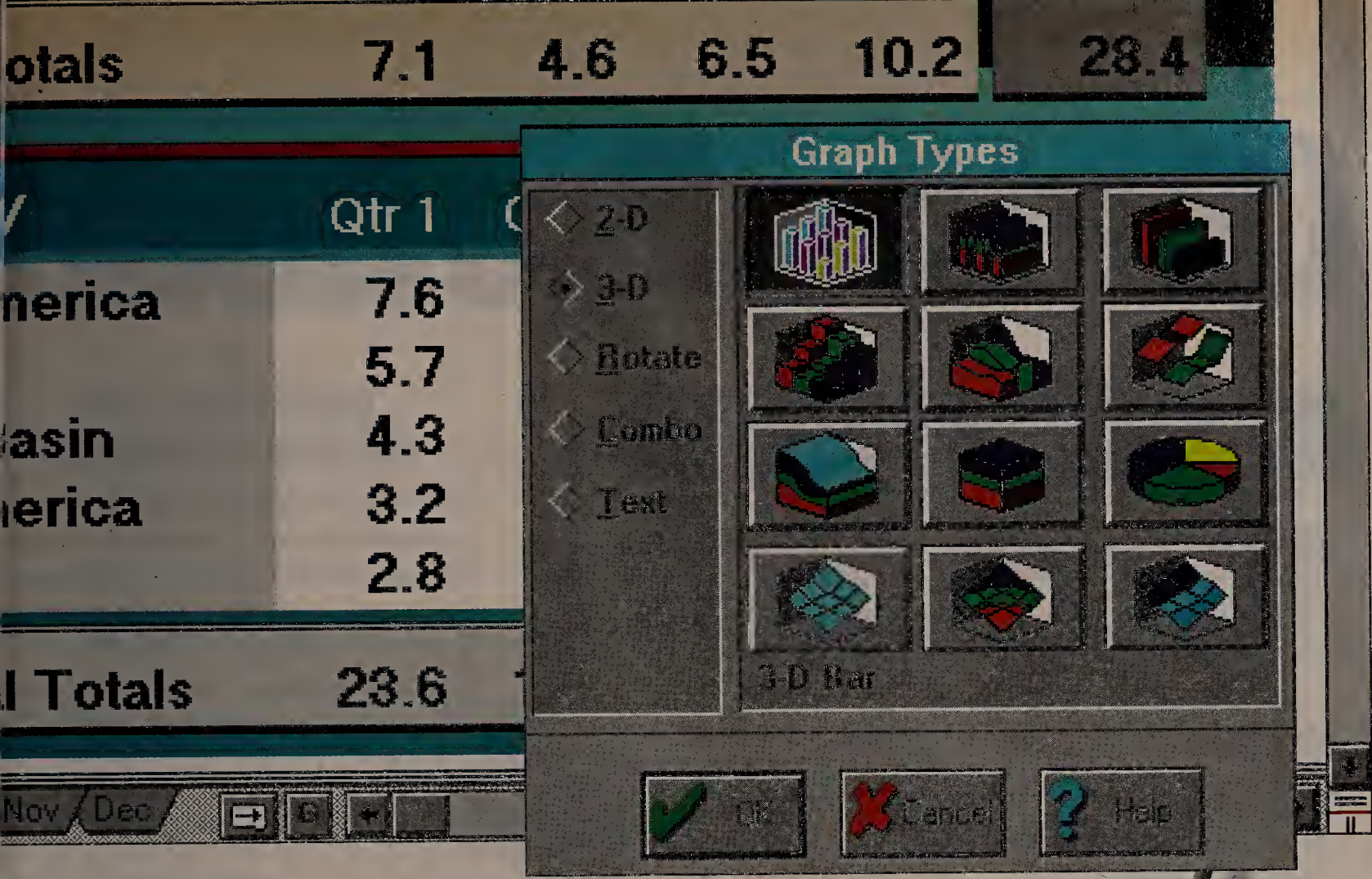
NEW! Presentation Graphics and drawing tools that rival those of Freelance and Harvard Graphics are built-in. You don't need to buy a separate graphics package.

YES! Compatible with Lotus 1-2-3 files, macros, and publishing styles and with Excel .XLS files.

Find your spreadsheet information in a flash!

From everyday tasks to complex projects, Spreadsheet Notebooks are the easiest way to work with your spreadsheets. By incorporating multiple spreadsheet pages in a single file (one notebook can handle up to 256 spreadsheet pages), you can break any complex spreadsheet into easy-to-manage pieces. Assign meaningful names to your notebook tabs and finding information is as easy as flipping through a notebook.

Notebooks are the smart way to do 3-D spreadsheets! You can present data in flip-chart style and format pages in a group, like chapters. Because you navigate easily, it's simple to build multi-page models.



Notebooks

You may never open the manual

Quattro Pro for Windows is the most usable spreadsheet ever. With Quattro Pro for Windows' object-oriented user interface, every action you take is easier and faster.

OBJECT INSPECTOR™ The Right Choice

Object Inspector menus let you make one-step changes to any object on your screen with just a click of the *right* mouse button—no more searching through layers of pull-down menus.

Context-sensitive, customizable **SpeedBars**™ give you pushbutton access to your frequently used commands. **Drag and Drop** lets you move or copy data instantly with the mouse.

Built-in graphics rival standalone packages

Quattro Pro for Windows gives you extraordinarily powerful graphics tools *built-in*. You'll never have to learn a separate graphics package.

Get 35 2-D and 3-D graph types—with thousands of variations. Then enhance your graphs by adding text, lines, arrows, and built-in clip art.

Use the **Slide Show** and **Light Table** to create incredible electronic presentations. Arrange and rearrange slide shows in seconds and customize them with dazzling transition effects.

You can create 35mm slides and overheads, too. No other spreadsheet gives you all this presentation power.

*Quattro Pro for Windows and Spreadsheet Notebooks have patents pending.

Circle 63 on reader service card

Notebooks

Object Inspector

Lotus 1-2-3 Compatibility

WinDOS Offer

Quattro Pro beats

Other spreadsheets don't compare

FEATURE	QPW	EXCEL 4.0	1-2-3/W R1.1	1-2-3 R2.4	1-2-3 R3.1
ORGANIZATION					
Spreadsheet Notebooks	Y	N	N	N	N
Nameable Tabs	Y	N	N	N	N
Group Formatting on Selected Pages	Y	Y	N	N	N
True 3-D Consolidation	Y	N	Y	N	Y
EASE OF USE					
Right Mouse Button Formatting	Y	Y	N	N	N
Object Inspectors	Y	N	N	N	N
Context-sensitive SpeedBars	Y	Y	Y	N	N
SpeedFill and SpeedFormat	Y	Y	Y*	N	N
Drag and Drop	Y	Y	N	N	N
GRAPHICS AND PRESENTATIONS					
3-D Graphs	Y	Y	N	N	N
Slide Show with Light Table	Y	N	N	N	N
Live Linked Graph Types and Formatting in Slide Shows	Y	N	N	N	N
DATABASE ACCESS					
Live View of Networked Database Tables	Y	N	N	N	N
Database Desktop	Y	N	N	N	N
CUSTOMIZATION					
Macro Buttons on Spreadsheet	Y	Y	N	N	N
Visual User Interface Builder	Y	N	N	N	N
COMPATIBILITY					
Reads Quattro Pro, Excel, 1-2-3 Files and Styles (including Allways & Impress)	Y	N	N	N	N
Runs Your QPro & 1-2-3 Macros†	Y	N	N	N	N
ANALYSIS					
Optimizer	Y	Y	Y	N	Y

*Requires add-in

†Some 1-2-3 macros may require modification.

Outstanding 1-2-3 and Excel compatibility

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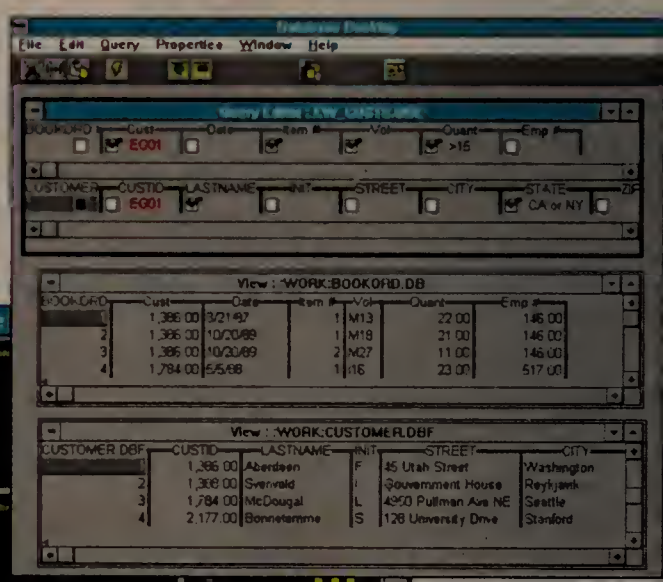
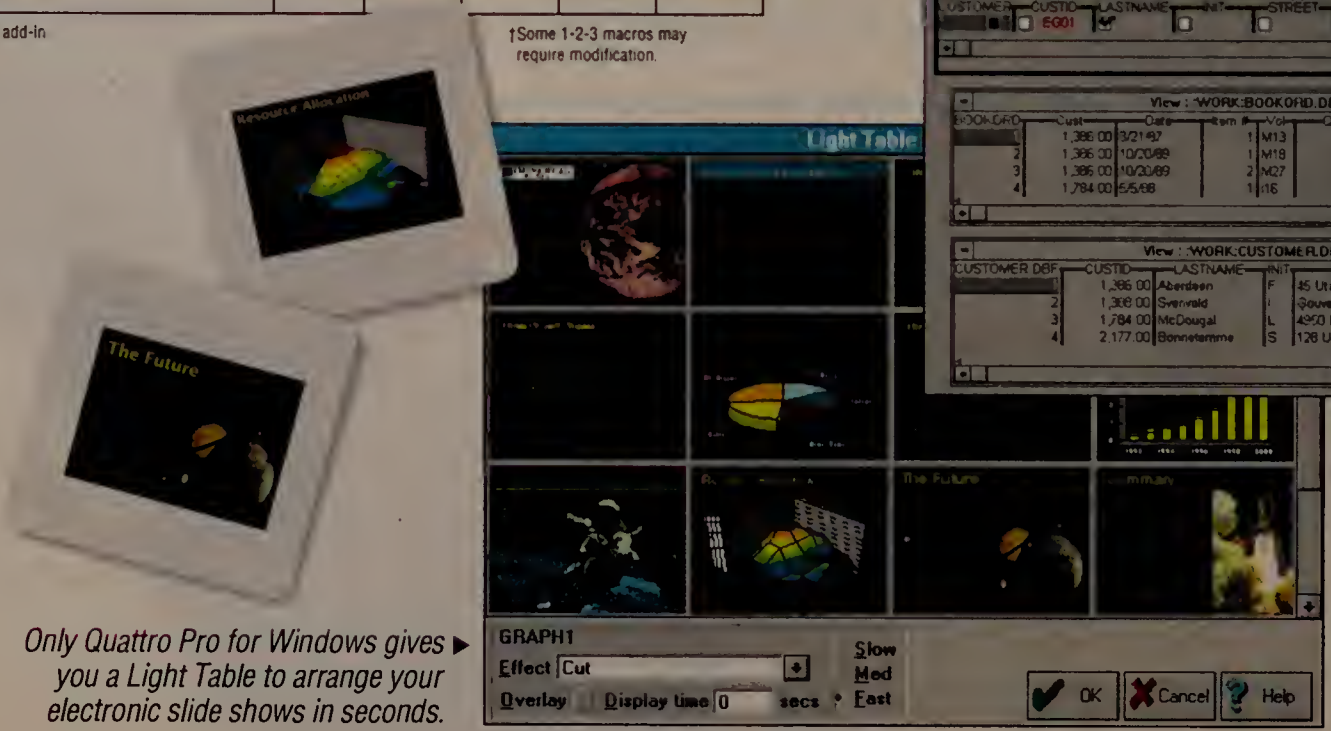


▲ *The Database Desktop: Only Borland makes access to dBASE and Paradox data this easy with QBE.*



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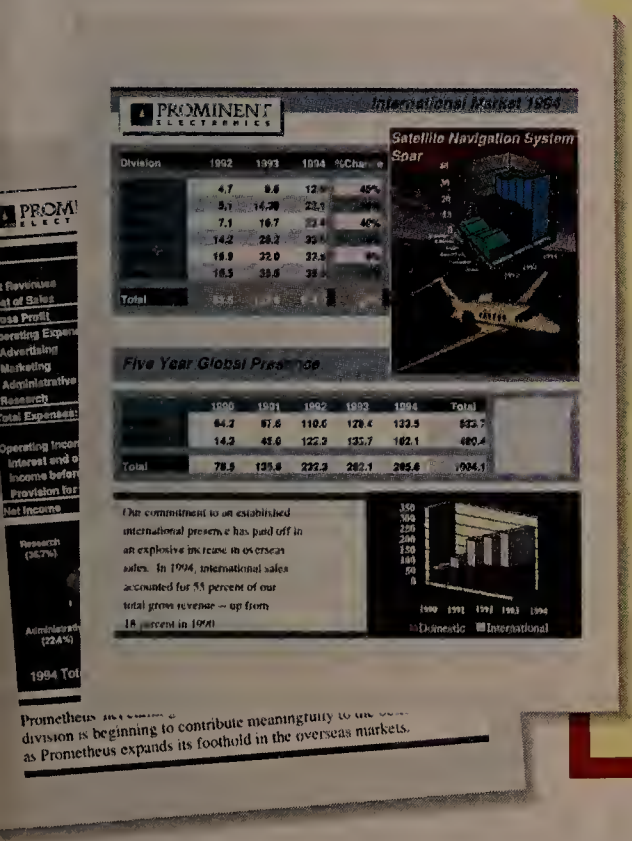

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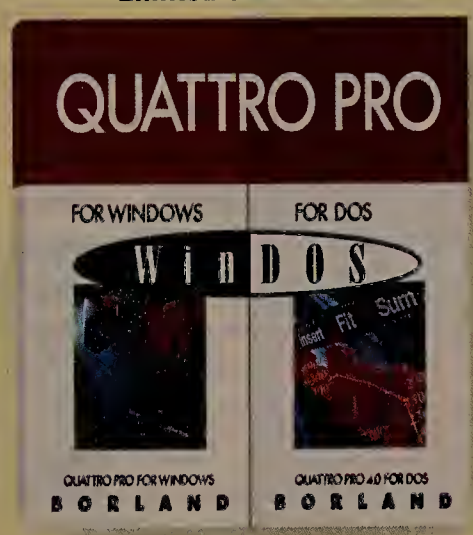

"Quattro Pro 4.0 [is] the ultimate DOS spreadsheet."
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Circle 63 on reader service card

Notebooks | Object Inspector | Database Access | 1-2-3 Compatibility | WinDOS Offer

DSPs Sow Seeds of New Products

The digital signal processor is The Little Chip That Can: a multipurpose engine that is fast, powerful, and cheap enough to bring advanced audio, video, communications, and pen-based applications to personal computers. You'll see the first results sometime next year in hand-held PCs and internal components that combine handwriting recognition with data, fax, and cellular communications, from companies such as Apple Computer, AT&T, and Intel. You can also look forward to a wave of upgradable modems that you can make run faster by, for example, downloading higher-speed software protocols from a vendor's BBS to your modem.

We'll soon see DSP-based add-ins that offer fax, data, voice mail, and other audio at street prices under $500.

A DSP chip is a very fast signal processor optimized to perform complex mathematical algorithms, making it ideal for fax, data, voice, image-handling, and other applications. Analog Devices, AT&T, Motorola, National Semiconductor, Texas Instruments, and many other chip makers recently introduced advanced DSPs that can be reprogrammed to perform additional functions—rather than dedicated to a single task. With a flexible DSP design, you're not necessarily limited to the features that the chip initially supports. Additionally, hardware designers may be able to cut costs by loading the DSP with multiple tasks.

Fixed-program DSPs are already at the heart of many high-speed modem chip sets, as well as such common products as compact disk players and cellular phones. DSPs aren't new to PCs—the original NeXT Computer, introduced in 1988, came with one for processing audio—and they're about to become ubiquitous. Today implementing DSP technology in PCs and peripherals costs about a third of what it did in 1988, says P. K. Dubey, director of processors for AT&T in Allentown, Pennsylvania. This means end users should soon see multipurpose DSP add-in boards that offer fax, data, voice mail, and additional audio features like voice annotation at street prices under $500.

Helping Hand-Helds

Products incorporating the new DSPs are already shipping. Motorola's $1350 InfoTAC wireless radio modem is capable of supporting additional modem protocols through software upgrades. Olivetti's Quaderno, a 2.2-pound subnotebook PC that has a built-in microphone, doubles as a PC and a voice recorder, employing Analog Devices' DSP engine to compress and decompress voice files stored on a 20MB hard drive.

Other hand-held PCs scheduled for release in 1993 also will make creative use of DSPs. AT&T's Personal Communicators will tap DSPs as general-purpose engines to handle data and fax communications, handwriting recognition, and other jobs.

Multimedia add-in boards for desktop PCs are in the works too. The pricey Intel/IBM Digital Video Interactive boards offer full-motion video and audio. IBM, Texas Instruments, and Intermetrics are developing a cheaper DSP-based hardware/software subsystem that can play stereo sound, display and compress images, and send and receive faxes and data. Called Mwave, the product will be included in members of IBM's upcoming Ultimedia line. Today's soundboards, and the audio hardware that Compaq and other vendors are beginning to embed in their systems, don't yet employ programmable DSP subsystems, but most vendors say that will be the long-term solution.

Remaking the Modem

Chip manufacturers are adding extra capabilities to their DSP-based fax-modem chip sets. While not upgradable, the newest chip sets from vendors such as Sierra Semiconductor and Rockwell International can digitize voice as well as handle fax and data. Hence many modem manufacturers will soon sell voice-ready fax-modems, including Logicode Technology of Newbury Park, California, which expects its voice-fax-data modems to cost less than $350 on the street.

Other vendors are forging ahead with plans to make programmable, DSP-based communications boards available by year-end. Digicom Systems' SoftModem technology, using an Analog Devices DSP, will let modem vendors build upgradable fax-modems. Among inexpensive offerings, Digitan Systems' DigiSound Pro, a soundboard that lets you train your PC to recognize voice commands, should be priced under $250 on the street. And National Semiconductor's new TyIN 2000 voice-fax-data modem, priced similarly to DigiSound Pro, provides a software-programmable DSP platform.

Intel Corporation plans to add voice features to its modem line next year, perhaps via programmable DSP-based subsystems, and sell the enhanced modems at prices

Putting the Pieces Together

What: Digital signal processors

Purpose: High-speed, multipurpose chips that perform complex mathematical algorithms

Advantages: Can be programmed for additional tasks, such as handwriting recognition or faster communications protocols

Costs: DSP-based boards with fax, data, voice mail, and audio functions will likely cost $300 to $500

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William D. Harrel, Windows Magazine, July, 1992

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Luisa Simone, PC Magazine, August, 1992

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Jon Honeyball, Windows Magazine UK, August, 1992

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Christina Wood, PC WORLD, July, 1992

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Corel	CorelDRAW!	CorelDRAW!	CorelDRAW!	256	14,000	$595

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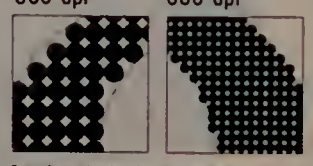
Circle 92 on reader service card

Other laser printers play leapfrog trying to catch up with the HP LaserJet.

Of course, luck won't get them far. Because the new HP LaserJet 4 printer sets such high standards for performance, value and ease of use that no other laser printer comes close.

Higher resolution. More typefaces. With the HP LaserJet 4, HP has moved the standard for print quality from 300 dpi to 600 dpi. That's twice the old resolution, but at less than the old 300 dpi price.



Four times the dots for better resolution.

The HP LaserJet 4 was designed for 600 dpi printing from the ground up. Which gives you the best 600 x 600 dpi resolution ever for noticeably crisper, clearer text and graphics.

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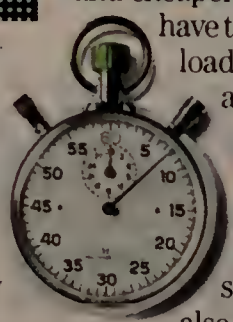
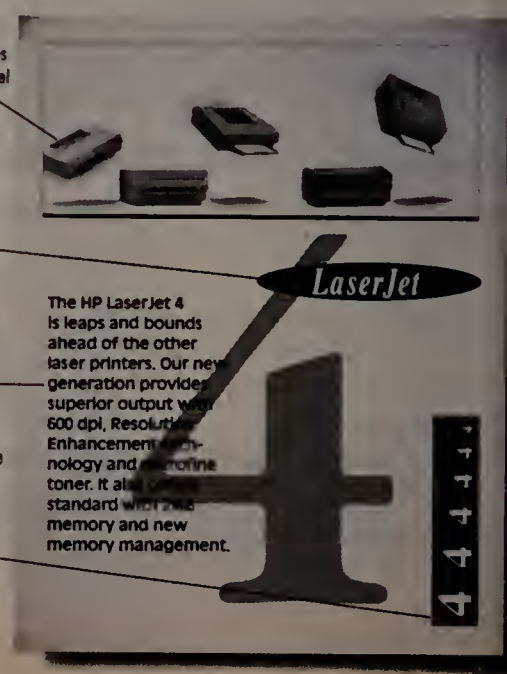


More speed, trays, and flexibility. Thanks to a high-speed RISC processor, the HP LaserJet 4 also sets new standards for speed. It prints many complex documents at rated engine speed, and many 600 dpi graphics print at a true 8 pages per minute. It's faster on networks, too. And has 2 MB built-in memory and new memory management.



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Introducing the HP LaserJet 4. Good luck, fellas!

It also makes you more efficient. Two standard paper trays give you a 350-sheet capacity. And there's an optional 500-sheet tray. So you can just keep on printing, instead of stopping to reload different sizes and types of paper.

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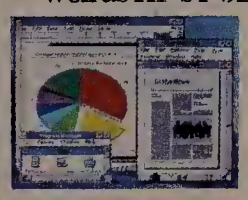
You can't beat the LaserJet 4 printer for compatibility, either. It works with a wide variety of LANs and computers, as well as HP's PCL 5 printer language and HP's optional PostScript Level 2 software from Adobe. And automatically switches between these languages.



And, of course, it offers complete document and software compatibility with the HP LaserJet III printer.

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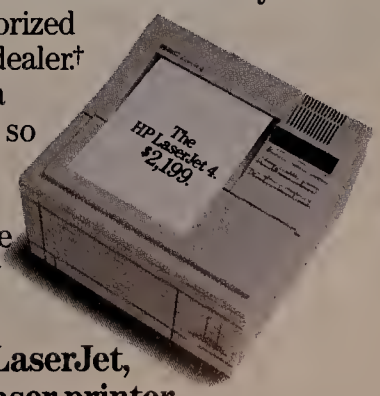

If it isn't a LaserJet, it's only a laser printer.

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*Suggested U.S. list price. †In Canada call 1-800-387-3867, Ext. 7132.** To have a LaserJet 4 printer data sheet sent immediately to you via fax machine, call 1-800-964-1291 from your touch-tone phone. Windows 3.1 is a product of Microsoft Corp. Adobe and PostScript are trademarks of Adobe Systems Incorporated which may be registered in certain jurisdictions.

Continued from page 70

comparable to current models, says fax-modem product manager Dan Wagner in Hillsboro, Oregon. Users will be able to dial in to their PCs and use voice commands to receive faxes or data files. Wagner adds that integrating voice, fax, and data protocols on a modem simplifies auto detection—that is, routing an incoming call as a fax, data, or voice message. And of course, users will be able to use their personal computers as phone answering machines, storing their messages on the hard drive.

Two modem vendors, The Complete PC and Prometheus Systems, already sell voice-fax-data modems to the home office market at prices under $500. Among corporate users, however, "there's not been a huge market for the integration of voice with fax and data," says marketing vice president Marshall Toplansky at modem maker U.S. Robotics in Skokie, Illinois. While voice mail is one of the most popular applications for voice-fax-data boards, large corporations already have sophisticated voice mail systems—and could better use voice support to create multimedia presentations and add voice messages to E-mail, document, and spreadsheet files. What voice needs to succeed, Toplansky adds, is a standard interface for voice, fax, and data protocols, in addition to a voice compression standard that will enable users to decompress and listen to voice files created by competing products.

DSPs Aid Product Innovation in 1993

Company	Product	Features
AT&T	Personal Communicators	Series of hand-helds with pen input, fax, paging, and cellular capabilities
Digicom Systems	SoftModem	Featuring Analog Devices' programmable DSP, this technology will let vendors market software-upgradable modems
IBM	Ultimedia	Multimedia hardware-software subsystem that compresses images, plays stereo sound, does fax-data transmissions
Motorola	InfoTac	Programmable wireless radio modem
National Semiconductor	TyIN 2000	A voice-fax-data modem with a software-upgradable DSP subsystem
Olivetti Office USA	Quaderno	Subnotebook PC with external microphone; uses DSP to record, store digitized voice

While digital signal processors aren't new to PCs, a new breed of programmable DSPs will lead to advanced multimedia and communications products.

Versatile Engines

DSPs alone do not an application make. Cutting-edge technologies like text-to-speech conversion, handwriting recognition, and full-motion video require sophisticated and expensive hardware and software. However, manufacturers and analysts agree that multipurpose DSPs are a solid foundation on which to build.

"What's important is the applications these chips can unleash," says Carolyn Rogers, senior technology analyst for Hambrecht & Quist in San Francisco. "These are very powerful chips, they're affordable, and . . . they'll unleash a lot of new applications," like voice-annotated and handwriting-enabled documents, spreadsheets, E-mail, and multimedia presentations.

—Jeff Bertolucci

On-Hold Music Awards (and Raspberries):

Anyone who's called a technical support line has spent time on hold. Most companies try to entertain their captive audience by piping in music from a local radio station or an internal soundtrack; an enlightened few even have live deejays who dispense music and chatter to fill the void. But there's no accounting for taste, and if you don't like what you hear, the wait can become downright unbearable.

As a routine part of a systems review, one intrepid *PC World* editor recently clocked a staggering 5 hours of hold time on technical support lines at 30 computer companies across the country. With that experience under her ear, the First Annual Unofficial PC World Golden Phone Awards (drumroll, please) go to Everex Systems and Tangent Computer, both of California. Everex piped finger-snapping Dixieland over the line, while Tangent offered cool jazz. Honorable Mention goes to Swan Technologies of Pennsylvania, which plays both new age and classical selections.

Sadly, companies displaying taste and compassion in their music choices were few and far between. No honors go to all companies that play the local Top-40 radio station, and we send greetings from limbo to companies that make their customers wait in silence. Our unofficial PC World Tin Ear Awards, with Bronx Cheer accompaniment, go to those companies who play Muzak. To add insult to injury, they were also the ones that made us wait the longest. These firms shall remain nameless, but you know who you are.

Whether your experience is the same may depend on when you call. Our editors have noticed that some vendors change their on-hold musical repertoire. This may reflect the varied tastes of those waiting—or the listeners' rising frustrations. After all, music hath charms to soothe the savage buyer.

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Toshiba Launches Three Low-Cost 386SX Notebooks

Toshiba's T1850C is one of three budget-minded portables. Its 25-MHz 386SX CPU, 80MB hard drive, 4MB of RAM, and active-matrix color cost about $3300.

The shot fired by Compaq last summer when it introduced its low-price desktops and portable systems continues to be heard around the PC world. The latest salvo in the price wars comes from Toshiba, with the introduction of three new budget-minded notebooks dubbed the Satellite series.

The T1800 is the cheapest of the low-price Satellites. It's a 20-MHz 386SX machine that gives you a 60MB hard drive, 2MB of RAM (expandable to 10MB), and a 9½-inch sidelit VGA monochrome screen for less than $1800 list.

Built-In Power

Both the T1850 and T1850C models use a 25-MHz 386SX processor, supported by an 80MB hard disk (120MB drives should also be available by the time you read this) and 4MB RAM standard (upgradable to 12MB). The T1850 notebook uses the same 9½-inch monochrome VGA screen as the T1800 and will cost just under $2200, while the T1850C is equipped with a sidelit, passive-matrix color display and lists for slightly under $3300.

All three Satellites use Toshiba's MaxTime power management, which monitors system components for opportunities to shut them down and save power. You also get a low-battery warning light and alarm and a gas gauge-style battery meter. Toshiba claims that with MaxTime empowered, the average user should get about 6 hours of battery life; if you bang away at the system continuously, expect closer to 3 hours. The color machine sucks more juice, so its battery life will be reduced by about a third. You have a choice of letting the machine decide how long to wait before powering down selected components, and setting the time-outs yourself.

Each Satellite is also equipped with a proprietary credit-card slot for plug-in memory modules (about $100 to $150 per megabyte, depending on size) and a modem slot ready to accept optional 2400-bps Toshiba data and fax-data modems (which cost $259 to $329 list).

Traveling weight for the Satellites, including the lightweight AC adapter, a power cord, a battery pack, and a Logitech TrackMan pointing device, is about 7½ pounds for the monochrome models and 8 pounds for the color. The keyboard has a full 82 keys, including 12 dedicated function keys and dedicated cursor keys in the classic inverted-T shape.

In Case of Breakdown

The machines are covered by a one-year parts and labor warranty and Toshiba's Exceptional Care service (which is free but requires separate enrollment). The service gives you access to 800 numbers for both phone and BBS queries. As part of the service, Toshiba promises that if your notebook can't be repaired within 24 hours, they'll send you a loaner unit free.

What you don't get with the Satellites are such amenities as a built-in modem, PCMCIA slots, or a docking station for your desk. That's part of the marketing focus—Toshiba is targeting users who just want a secondary system and who won't use a portable as their everyday computer. Those who want the Toshiba name without sacrificing features will want to look at the company's other current product lines.

Pricing Is on Par

Compared with other low-end notebooks we've seen recently, the Satellites are competitively priced. Compaq's Contura 3/20, for example, with a 40MB hard drive and 2MB RAM, is only $100 cheaper than the T1800. The Contura 3/25 lists for $2099, compared with the T1850's $2199.

The bottom line for buyers? You get both affordability and the peace of mind that comes with a big name. In times like these, with discretionary budgets cut to the bone, that could well be a winning combination.

The T1800 is available now, as are the 80MB versions of the 1850 and 1850C. The 120MB versions of the 1850 and 1850C should be available by the time you read this.

—Dan Miller

Toshiba Satellite notebooks

Three new models from the portable-computing giant give buyers straightforward functionality for a low price.

Toshiba America Information Systems, Inc.
800/334-3445
List price: T1800 $1799, T1850 $2199, T1850C $3299
Reader service no. 601

HP's New Ink Jets: The Speedy 550C Color and the 4-Pound Portable

Hewlett-Packard's new printers, the HP DeskJet 550C and the HP DeskJet Portable, offer an ink jet solution for almost any business need. The $1099 550C prints both true black and color documents. The $599 Portable costs more than many portable dot matrix units but delivers much better output. Both printers support a laserlike maximum resolution of 300 dots per inch (dpi).

Normally, color ink jet printers produce black by mixing colors. But the 550C's two printheads give you true black as well as color. The 550C's speed has been boosted to up to four times that of previous DeskJets, Hewlett-Packard claims. Mixed color and black documents print at 4 to 7 minutes per page; straight black text prints at 3 pages per minute.

The 550C's new paper-handling mechanism automatically feeds envelopes as well as letter, legal, A4, and executive-size stock. The paper tray holds 100 letter-size sheets or transparencies or 20 envelopes.

HP includes new portrait Univers and landscape Letter Gothic typefaces and increased type sizes for its portrait Times font. It supports *Windows 3.1* and *3.0* scalable fonts and TrueType fonts and accepts cartridges and soft fonts designed for earlier HP DeskJets.

HP's $599 4-pound DeskJet Portable delivers 300-dot-per-inch ink jet output—much better than portable dot matrix printers.

HP's 4-pound Portable has a $99 optional 3-pound sheet feeder. It measures only 13 by 3.5 by 9.5 inches and produces 3 pages per minute.

The Portable's four built-in fonts range from 6 to 14 points in portrait mode and from 5 to 24 in landscape. TrueType scalable fonts are also supported.

The Portable uses AC power or camcorder batteries. Battery life—about 100 pages—is aided by a "sleep" mode that kicks in after a few moments of inactivity and a shutdown mode that activates after 15 minutes.

—Jim Forbes

HP DeskJet 550C, HP DeskJet Portable

The $1099 DeskJet printer can simultaneously print color and true black with resolutions of up to 300 dots per inch. The $599 portable ink jet printer weighs only 4 pounds and is designed for mobile professionals.

Hewlett-Packard
800/752-0900,
800/387-3867 (Canada)
List price: 550C $1099, Portable $599
Reader service no. 602

Tecmar's Compression Technology Yields Fast, Cheap Tape Drives

Tecmar is making an aggressive foray into the QIC DC600 tape drive market with its QICVault Series. These drives boost maximum compressed capacities to about 720MB and transfer rates to as high as 15MB per minute.

To achieve the increased capacity, Tecmar uses a proprietary encoding technique to pack in additional data. The result is a drive that can handle 360MB of uncompressed files. With a compressed capacity of about 720MB, it's capable of handling backups on drives as large as 650MB.

Tecmar packages its drives in a number of configurations, all of which are also compatible with tapes from QIC-120MB and QIC-250MB drives. The higher-end Gold and Silver models offer DOS, OS/2, *Windows*, and Novell backup software; SCSI hardware compression boards are optional. The Gold and Silver models have transfer speeds up to 15MB per minute when used with 33-MHz 486 PCs.

The lower-end Bronze model includes a DOS program with data compression and can be paired with an optional SCSI tape adapter. Tecmar touts its transfer speeds as 10MB per minute with a 33-MHz 486.

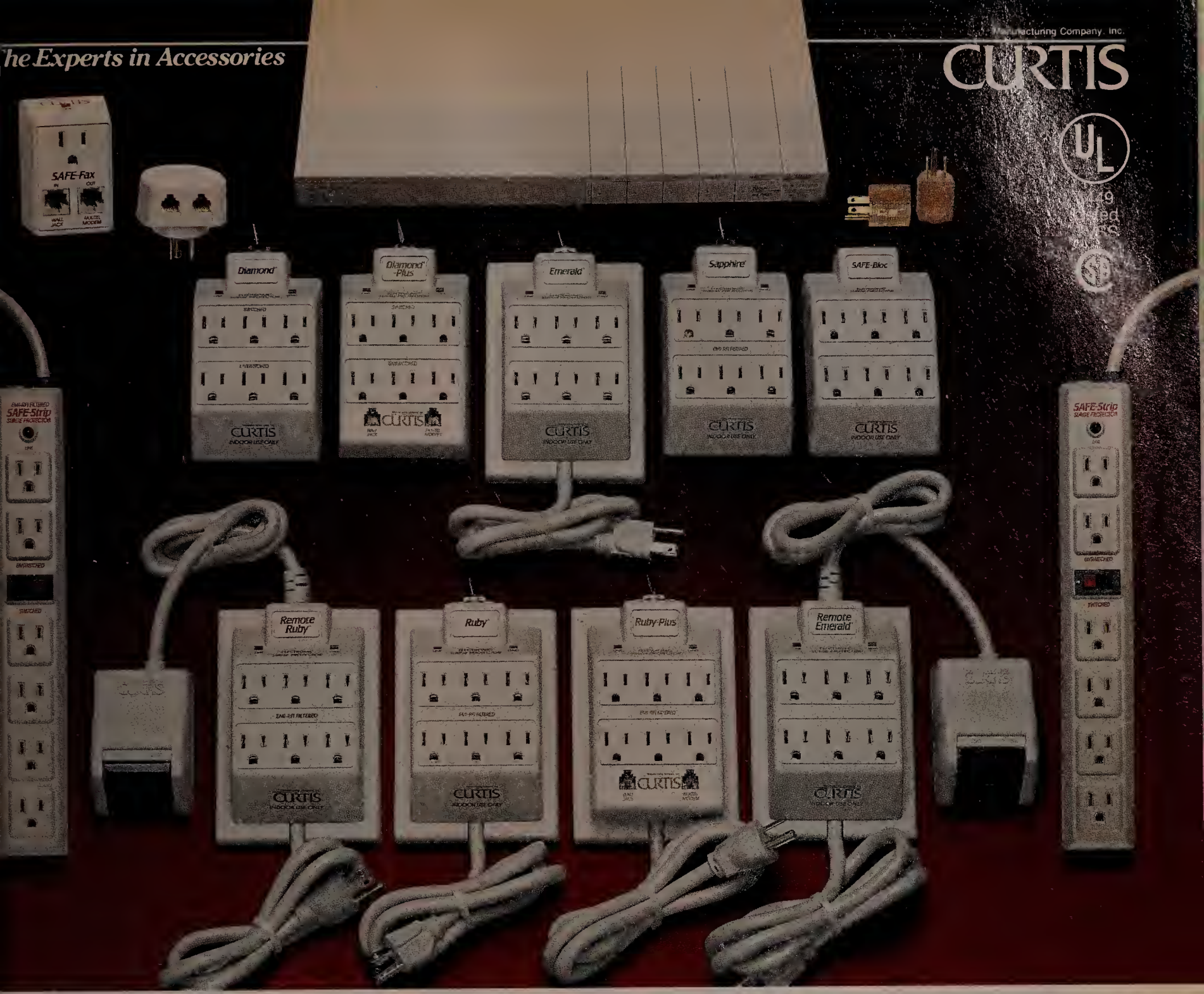
The company includes an extended-length tape and a two-year warranty with all units. All models are available as external and internal drives except the $1889 Gold model, which comes in a deluxe tower cabinet. The Silver external and internal models are $1489 and $1189 respectively; the external and internal Bronze models are $1439 and $1139. ISA and MCA SCSI adapter boards list separately at $229 and $279. ISA and MCA compression boards are $399 and $499.

—Rex Farrance

QICVault Series

These 720MB tape drives offer low price plus a speed boost over similar DC600 products.

Tecmar
800/422-2587,
216/349-0851 (fax)
List price: $1139 to $1889
Reader service no. 603



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Removable-Media Hard Drives: Bigger and Better

Available in 44MB and 88MB versions, the 5¼-inch Puma portable drive's parallel port interface makes it compatible with just about any PC or notebook.

Desktop publishers, multimedia mavens, those who need fast and secure backups, and anyone who generates vast amounts of data will sing the praises of removable-media hard disks. They're inexpensive, and when disk space runs out, you just slide in a new cartridge. Until recently, the maximum per-disk storage amount was 90MB. Now SyDOS has pushed the edge of the envelope with a new 3½-inch IDE product, the Marlin Series internal and external drives. Their 105MB capacity increases the top per-disk capacity by more than 15 percent.

In another innovation, SyDOS has also created a drive with a parallel-to-SCSI interface, so you can move an external drive from PC to PC without having a compatible SCSI host adapter installed. The 5¼-inch Puma portable drives come in 44MB and 88MB capacities and use a parallel port interface that makes them compatible with just about any PC or notebook.

The Marlin drives may well set a new mark for speed: SyDOS reports a 14.5ms average seek time. SyDOS drives and media are constructed using standard Winchester heads and disks, which helps explain their speed. The Puma drives can't match the speed of the Marlins, although their 20ms average seek time is still respectable. Because the Puma uses a parallel interface, you can expect data throughput to be slower than on a standard SCSI host adapter or IDE interface.

In addition to increased capacity and the promise of greater speed, the Marlin drives offer the convenience of a media size that's remarkably similar to a 3½-inch floppy disk—just a little thicker. That means that you can pop a disk into your pocket if you have to carry data home or across the office to another drive.

Both drives come with a data cartridge, a two-year warranty, and a mean-time-between-failure rating of 100,000 hours. SyDOS warrants its media for a full five years of continuous use. The Marlin internal drive costs $1119, the external parallel drive is $1198, and the external SCSI version is $1398. The Puma 44 is $638, and the Puma 88 lists for $799.

—Rex Farrance

Marlin Series, Puma drives

Now you can store 105MB per disk on a new 3½-inch removable-media IDE hard disk or pack up to 88MB on an inexpensive 5¼-inch model with a parallel port interface.

SyDOS
800/437-9367,
407/998-5414 (fax)
List price: Marlin $1119 to $1398, Puma $638 to $799
Reader service no. 604

At Last Color Scanning Arrives at Gray-Scale Prices

ScanMaker II, ScanMaker IIXE

Two new inexpensive units can scan 24-bit color, 8-bit gray scale, line art, and halftones.

Microtek Lab
800/654-4160,
310/538-1193 (fax)
List price: ScanMaker II $900, ScanMaker IIXE $1699
Reader service no. 605

Veteran supplier Microtek Lab is making color scanning available to a new class of users. The entry-level ScanMaker II costs only $900—less than some gray-scale scanners—while the company's top-of-the-line ScanMaker IIXE is expected to sell for about $1699.

Both can be used to scan images in 24-bit color (16.8 million colors) or 8-bit gray scale (256 shades), either halftones or line art. Both products support a resolution of 600 by 300 dots per inch (dpi), which can be boosted to an interpolated 1200 by 1200 dpi with an included scanning utility.

One key difference between the products is their bundled software. The ScanMaker II comes with Microtek's *ImageStar II for Windows* software for color and gray-scale editing; Macintosh users receive *Adobe Photoshop LE*.

The high-end ScanMaker IIXE is geared to professionals who want full prepress support. The IIXE comes bundled with Aldus *Photostyler*, a sophisticated image-editing application that runs under *Microsoft Windows;* Macintosh users receive the full version of Adobe's *Photoshop*, and *ScanMatch*, which allows users to calibrate their monitor's color display precisely to the scanner.

If you need optical character recognition capabilities, you can use your favorite OCR software with either scanner. The IIXE supports an optional document feeder that feeds up to 50 pages of text automatically.

—Jim Forbes

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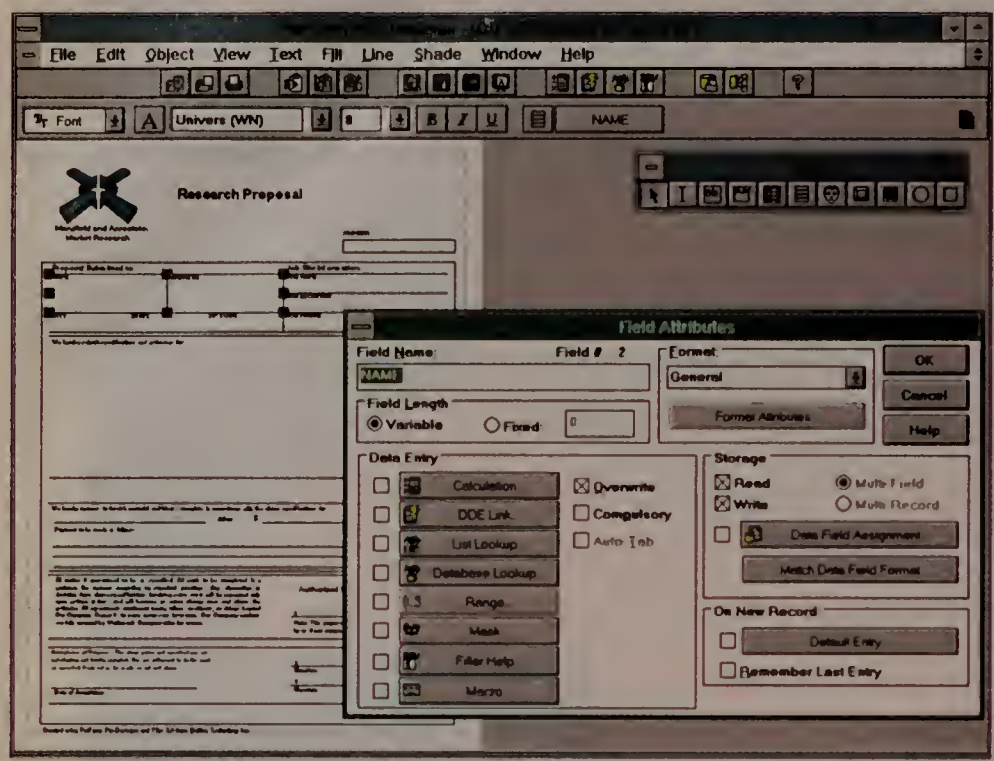

PerForm Pro Plus's design tools rival those of high-end DTP programs. Each field can have its own pop-up help window, and forms accommodate custom buttons.

The new *PerForm Pro Plus* goes far beyond typical form packages. In addition to letting you create good-looking forms, it now provides a superior set of object-oriented form-design features and extensive tools for linking forms, so you can create an automated system for controlling office work flow. You can also develop forms that collect and store information from standard database files. Add built-in fax capability, and you've got a steal at $399 ($79 for upgrades).

Treasure Trove of Tools

PerForm Pro Plus's arsenal of design tools rivals that found in high-end desktop publishing programs, and you can build a great deal of intelligence into your forms, much as you would in a spreadsheet. For example, fields on a form can be preformatted, used in table lookup or other validation operations, linked to fields on other forms, or used in calculations. Each field can have its own pop-up help window, and forms easily accommodate elements such as custom buttons, check boxes, and radio buttons.

The product supports common database file formats such as *dBASE*, *Paradox*, and *Clipper*. Better yet, you don't have to limit a form or collection of related forms to one database file or format—which means you won't have to make drastic changes to existing database procedures. In fact, you don't even need database software to use these capabilities, since *PerForm Pro Plus* can generate database files and perform routine form-based queries. The program can even generate a form automatically, based on the fields in an existing database file.

The package consists of two main modules: the form designer program, used to design forms and form systems, and the form filler program, which accepts input and works with the database files. As you design the forms, you can set both read and write options for each field and incorporate security features to limit access to specific fields or entire forms.

PerForm Pro Plus takes full advantage of *Windows 3.1*, supporting DDE and OLE as both client and server. The user interface is finely crafted. The multiple document interface lets you copy and paste objects easily between forms. With a pulldown list, you can quickly select a tool ribbon appropriate for the task at hand. Right-clicking an object pops up a dialog box that lets you edit the properties.

Objects Speed Form Design

The package ships with several object libraries—collections of prebuilt objects such as telephone number masks, an invoice table with built-in calculations, and special effects such as drop shadow boxes. Simply open a library, and drag the desired object onto your form. You also get a selection of useful symbols and graphic objects to further embellish your forms. *PerForm Pro Plus* can import ten graphics formats and generate eight different types of bar codes.

The form filler program lets you easily retrieve a form or a group of related forms called a folder. Filling forms on screen involves standard mouse and keyboard conventions familiar to all *Windows* users. You can print blank forms or completed forms, and the product provides plenty of print-time options that let you set the output quality. You can also omit objects such as bit maps or patterns at times when speed is critical.

Since this product does so much, don't plan on mastering it overnight. Working through the tutorial will teach you the basics, and the package includes more than 100 form templates to get you started.

To make your life even easier, Delrina tosses in five complete applications that demonstrate how forms can work together, and you can use these as the basis for developing your own systems.

Such form-based systems rely on macros that use the built-in macro language, which includes 240 predefined macros. You can write or record your own macros and attach macros to on-screen buttons.

Delrina should have a winner on its hands with *PerForm Pro Plus*, and the company has plans to make this comprehensive package even more useful. Two additional modules are in the works: a communications component to tie into E-mail systems, and a server-based SQL option.

—John Walkenbach

PerForm Pro Plus

WINDOWS **This comprehensive forms package packs a load of features, including macros and support for databases, that can help automate many aspects of your office work flow.**

Delrina Technology
800/268-6082
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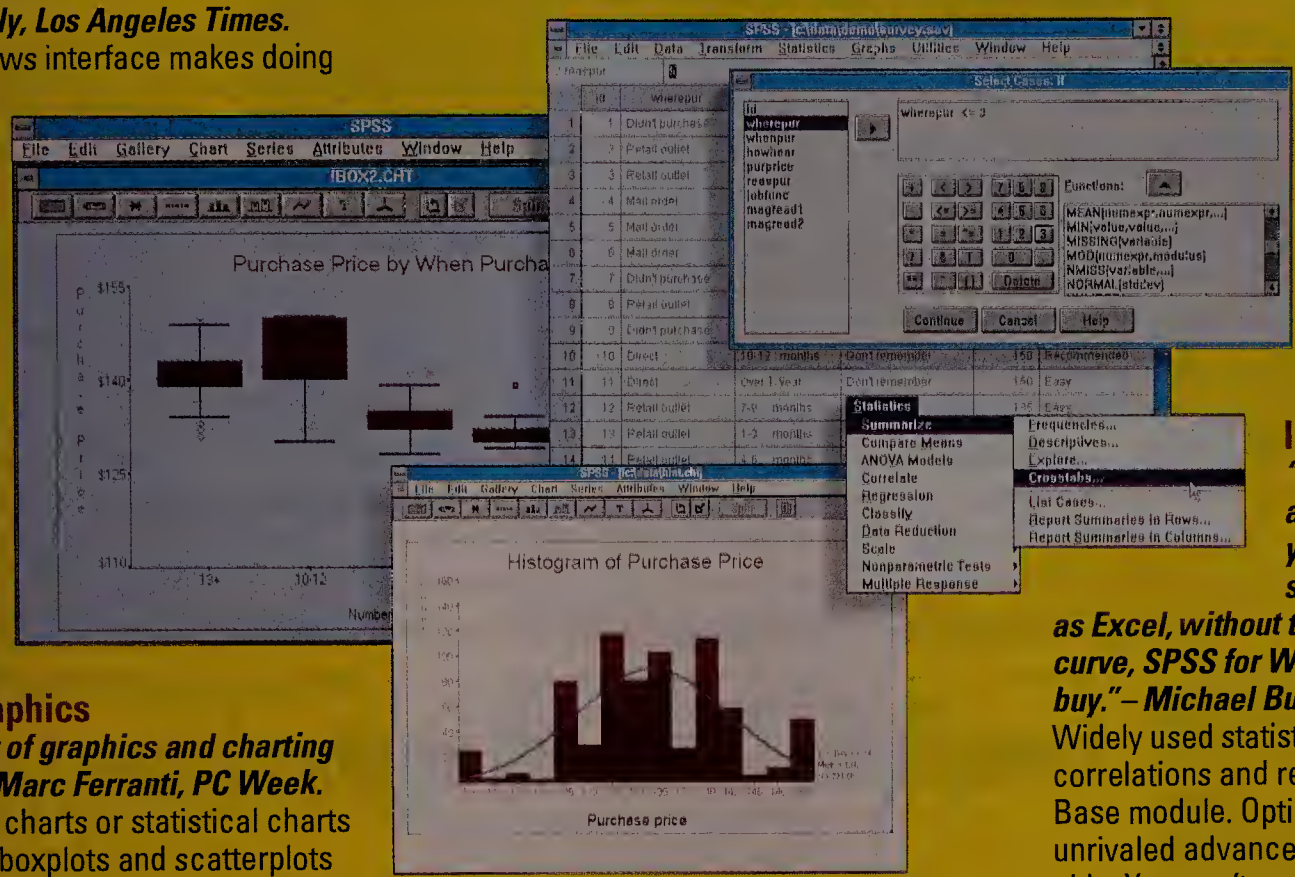

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"For more statistical analysis tools than you'll get from a spreadsheet such as Excel, without the steep learning curve, SPSS for Windows is a great buy." – Michael Burgard, PC/Computing. Widely used statistics such as crosstabs, correlations and regression are in the Base module. Optional modules with unrivaled advanced statistics are available. You won't grow out of this package.

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Superbase Fights Back With a New Interface

Since its debut in 1989, *Superbase* has had little competition in the *Windows* relational database market. But with the recent release of *Paradox for Windows* and *Microsoft Access*, *Superbase* suddenly has company. Not content to sit back and watch Microsoft and Borland steal its market, Software Publishing is fighting back with *Superbase 2*. This update is a total overhaul that attempts to address the product's biggest problem—its difficult, nonstandard user interface.

The new *Superbase* sports an icon bar and uses *Windows 3.1*–style dialog boxes and help. SPC has reorganized the program's obtuse menu system, renaming options such as Process and Set to the more understandable Data and View. The product's oft-maligned table view now actually looks and functions like a spreadsheet instead of a scrolling output window. The upgrade also offers two methods to query a database: its own proprietary but powerful querying method and a new *Paradox*-style query-by-example (QBE) module.

In prior versions of *Superbase*, it was especially difficult to define two-table forms with multirow detail blocks (used, for example, in order-entry systems to display an order with multiple line items). *Superbase*'s form designer now supports this common type of form directly without requiring the user to resort to programming. Power users and developers will be happy that SPC has beefed up the *Superbase* BASIC-like programming language and added macro support, a debugger, and menu and dialog box editors. And *Superbase 2* lets you export *dBASE* files and provides support for *Paradox* files.

Superbase 2 features a Paradox-style query-by-example tool as well as its own proprietary yet powerful querying method.

SPC has improved *Superbase* considerably with this long-awaited upgrade. Unfortunately, a few rough edges remain. For example, in most *Windows* programs, when a scroll bar has no purpose, it's not displayed. In *Superbase*, however, inoperable scroll bars are often displayed, emanating annoying beeps when accessed mistakenly. And unlike in *Paradox*, the new QBE module forces users to check the same field multiple times for complex queries.

Superbase 2 is a significant upgrade, but with Microsoft and Borland close on SPC's heels, it remains to be seen whether the changes have gone far enough. The product will sell for $795; *Superbase II* and *IV* users can upgrade for $149.

—Paul Litwin

Superbase 2

WINDOWS A much improved version of this *Windows* database includes a more consistent interface and query-by-example capabilities.

Software Publishing Corp.
408/986-8000
List price: $795
Reader service no. 607

Fontographer Creates and Modifies Fonts

If you ever wanted to tweak an existing font's appearance, design your own fonts, or create a logo you could access with one keystroke, *Fontographer 3.5 for Windows* may be just the tool you need.

Fontographer lets you create fonts from scratch or edit fonts in several popular formats: Type 1 PostScript (Adobe Type Manager–compatible), TrueType, Encapsulated PostScript, and *Windows* bit maps. You can use fonts you create in any application that supports those formats.

The $495 program supports a constellation of font attribute options, including weight, line spacing, and ascent and descent. Once you've created information for the typeface as a whole, you can design individual characters; skew, scale, and rotate; or import selected characters from other fonts.

Fontographer comes with drawing and editing tools for creating and modifying characters and for editing *font hints*, the typographic information built into each character that affects its consistency of appearance at different resolutions and point sizes. *Fontographer* will provide hints for a font automatically, or you can create your own. The drawing tool supports multiple "layers," providing a place to draw guidelines for freehand lines that don't appear in the rendered font.

The excellent documentation includes a glossary as well as a separate tutorial book for the use of novices. *Fontographer* requires at least a 386-based computer running *Windows 3.1* with 4MB of RAM.

—Jeff Angus

Fontographer 3.5 for Windows

WINDOWS Create your own fonts or modify existing ones with this sophisticated font package.

Altsys Corp.
800/477-2131,
214/680-0537 (fax)
List price: $495
Reader service no. 608

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- 64K External Ram Cache (128K on 486DX-33)
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- CTX 14" SVGA Non-Interlaced Monitor with .28mm Dot Pitch & 72hz Refresh Rate
- ET4000 Windows Accelerator Super VGA Card with 32,768 Colors Maximum
- 4mb High Speed Ra
- 1.2mb & 1.44mb Fl Drives
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486DX-33 $2699

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- CTX 17" SVGA Non-Interlaced Monitor with .31mm Dot Pitch & 72hz Refresh Rate
- ET4000 Windows Accelerator Card w 32,768 Colors Max
- 8mb High Speed Ra
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- Desktop or Mini-To Case with 5 Drive E
- DOS 5.0, Windows & Hi-Res Mouse
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486DX-33 $2699

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All EISA systems come standard with a DTC 32-Bit IDE EISA controller for maximum drive performance!

- 486 Processor (with Internal Coprocessor)
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- ET4000 Windows Accel.Super VGA C with 32,768 Colors
- 8mb High Speed Ra
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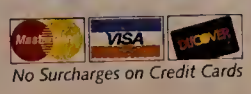
Order line open 7 AM - 7 PM (PST) Mon - Fri 8 AM - 4 PM Weekends. Prices and Money Back Guarantee do not include shipping. Fortune 1000 POs (no surchages)& Business Leasing available on approved credit.



No Surcharges on Credit Cards

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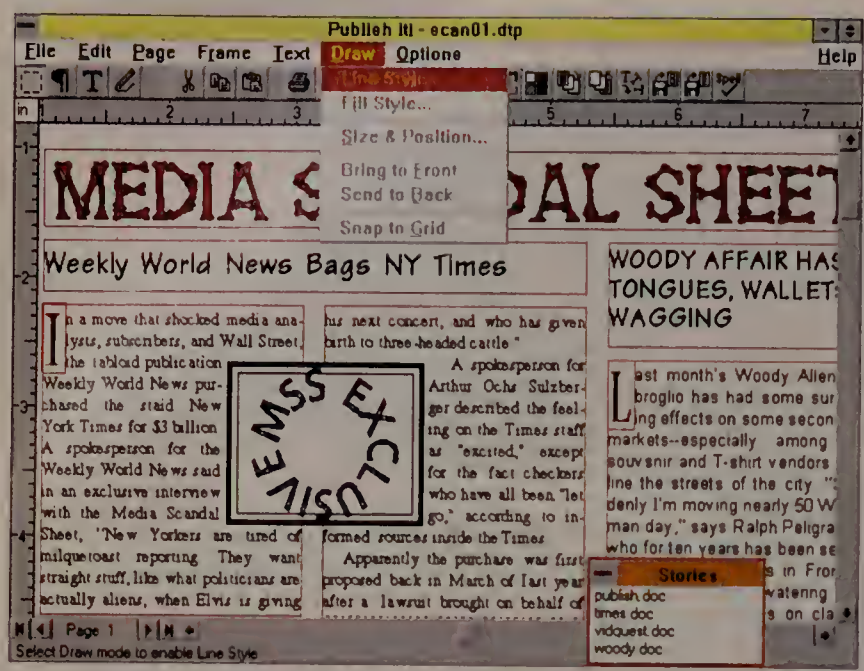
Publish It Comes On Twice as Strong With DOS and Windows Versions



The PowerText option in Publish It for Windows makes it easy to set text beside a circle or create a drop cap.

In our January 1992 review of low-cost desktop publishers, we ranked *Publish It 2.0* the best and easiest to use of the non-*Windows* packages. Version 3.0 builds on that legacy, while the new *Publish It for Windows* should challenge the leaders in the *Windows* arena.

Both packages share a sleek new interface, with a toolbar for mousable access to common commands, plus 3-D buttons and dialog boxes. In fact, *Publish It 3.0* bears a striking similarity to its *Windows* counterpart, with a few subtle differences: The *Windows* toolbar gives more immediate access to tools and is context sensitive.

Publish It 2.0's 8 fonts were scalable, but you had to set their sizes and generate them before creating a document. Version 3.0's 20 fonts are now scalable on the fly from 3 to 250 points, while the *Windows* product offers 25 PostScript Type 1 fonts as part of a bundle with *Adobe Type Manager*. You can have real fun with those fonts courtesy of PowerText, a feature that lets you rotate, skew, mirror, or place text on a curve. You can even fill characters with colors and patterns.

Publish It still offers exceptional style sheets; the ability to wrap text around objects; control of kerning and line, word, and letter spacing; fundamental drawing tools; and even some basic image-editing capabilities that you can use to touch up scanned images.

In the new DOS version, these talents are augmented with the Template Manager, a handy feature that offers a thumbnail view of all 100-plus supplied templates in addition to a miniature preview of any document that you select. Just as handy, both versions of *Publish It* now have an 80,000-word spelling checker. You'll find more than 150 pieces of clip art, and the program will import a slew of file formats.

DOS and *Windows* versions are $149.95 each, with an upgrade price of $49.95, and carry a 60-day money-back guarantee. If you choose to buy the program on CD ROM, you get a bonus: additional fonts, templates, and approximately 3000 clip art images.

—Steve Fox

Publish It 3.0, Publish It for Windows

WINDOWS **The easiest-to-use DOS DTP package embraces *Windows*, while a new DOS version adds a *Windows*-look-alike interface, special text effects, and fully scalable fonts.**

Timeworks
800/323-7744,
708/559-1399 (fax)
List price: $149.95
Reader service no. 610

Golden Retriever Fetches Windows Files

Golden Retriever can give you a whole new perspective on managing *Windows* files. Instead of organizing files by application, *Golden Retriever* emulates the Macintosh, allowing you to catalog files by project or topic.

When you install the $99 utility, it searches your hard disk for both *Windows*- and DOS-based applications and then sets up six "empty" file drawers with three folders in each.

To create a new file, you first choose the drawer and folder you want to store it in, give the file a name, and then choose the application you'll create it with—a process that differs from the usual *Windows* and DOS approach and may take some getting used to.

The advantages? Once you have stored files created with different applications in the same folder, it's easy to work on a project requiring more than one app. To launch any application, you simply click on its file name; *Retriever* does the rest. And if you use a file for several projects, you can list it in several folders without having to duplicate it, saving disk space.

But *Golden Retriever* doesn't automatically go out and find your existing files because it doesn't know how you'll want to organize them. You have to import those files into *Golden Retriever* to benefit from its organizing and file-naming features. Fortunately, the program's file manager function makes it easy to import single files or entire directories. It displays two drive windows at once by default.

Golden Retriever supports long file names; you can use 256 characters to describe a file. The program requires *Windows 3.0* or later, at least 2MB of RAM and 1MB of free hard disk space, and a mouse.

—Reid Goldsborough

Golden Retriever 2.0

WINDOWS **This Windows utility uses a more visual, Macintosh-like approach to organizing and using files.**

Above Software
800/344-0116,
714/851-2285 (fax)
List price: $99
Reader service no. 609

Here.

There.

Everywhere.

The HP DeskJet Portable.

$599.

Hewlett-Packard presents the DeskJet for the jet set. The new HP DeskJet Portable printer lets you create great-looking documents anywhere you go.

It's small enough to fit in a briefcase and weighs only 4.4 pounds. But the DeskJet Portable prints high-quality 300 dpi black and white text and graphics on plain paper, transparencies or labels.

It's everything you expect from your office printer in a portable package. Compatibility with most major software. A fast print speed of up to three pages per minute. A wide variety of typefaces, sizes and styles. And Hewlett-Packard inkjet technology, so you don't have to sacrifice print quality for portability.

The DeskJet Portable is built tough to take more than the usual amount of jostling. And, to make it even more versatile, an optional rechargeable battery is available, along with a World-wide Rapid Recharger, a 50-page cut-sheet feeder and a handy carrying case.

To top it off, the DeskJet Portable has a price tag befitting its small size. Just $599.* Who says you can't take it with you? Call 1-800-552-8500, Ext. 7108,† for the name of the authorized HP dealer nearest you. To receive information by fax call 1-800-333-1917, choose HP FIRST, document #9606.

DeskJet Printers
Make it happen.

STAYING PRODUCTIVE AWAY FROM THE OFFICE

HOME:

For one reason or another it's sometimes impossible to avoid having to bring work home. Occasionally there simply isn't enough time in the day to finish all your work while at the office. On the other hand, some people prefer the environment of home when working on certain tasks. Whether it's bookkeeping or letter writing, it's important to have the equipment and space you need at home to get work done.

CLIENT:

Business travelers often find themselves called upon to take care of important details while visiting the client's office. When that occurs, it's best to have immediate access to as many resources as possible. Be sure that someone at your home office is familiar enough with your personal files that they can quickly find anything you need. A portable computer can be a highly effective way to store a roomful of files in a compact unit that can be accessed easily.

HOTEL:

A hotel can be a very peaceful, distraction-free environment for getting work done. And, since many hotels cater almost exclusively to business travelers, you'll find they are usually well-prepared to assist you with all your business travel needs. Copy machines, fax machines and, in some hotels, personal computers are available to help you get your work done when separated from the conveniences of the home office.

BRANCH OFFICE:

While visiting company offices in different cities, you may find it necessary to set up a separate work space there. If this is not possible, have an assistant from the office you're visiting assigned to you. He or she can help you find the equipment and services you need to stay productive.

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*Suggested U.S. list price. Optional cut-sheet feeder not included.
†In Canada call 1-800-387-3867, Ext. 7108.

Accounting Gets Graphical With Flexible Dynamics

Although there are plenty of *Windows* bookkeeping packages, few offer all the features of a high-end accounting program. But now, after five years of development, Great Plains Software has introduced *Dynamics*, a new *Windows* accounting system that promises even more sophistication than the company's DOS-based *Great Plains Accounting Series*.

Dynamics is aimed at companies with annual sales of between $5 million and $200 million. It's especially suited for allocating work in a larger accounting department, because you can set up customized daily, weekly, and monthly task lists for each user.

Flexibility is one of *Dynamics'* main strengths. You can lay out reports the way you want—for example, modify input screens and prompts and add or delete selected accounting data fields.

Unlike traditional accounting packages, *Dynamics* is organized around a series of accounting tasks, such as sales and purchasing, instead of broken down into the usual full-fledged modules such as accounts receivable, accounts payable, and so on. This design means you can pick and choose the depth of accounting functions you require. For example, you can start out with the basic *General Ledger* module, which gives you 20-digit ledger account codes. If that isn't sufficient, you can add the *Account Number Expansion Kit* module to increase ledger codes to 45 digits.

For many businesses, this approach can make *Dynamics* more cost-effective than other high-end programs, since companies can buy less-expensive packages focused to their specific needs. And as a company's accounting operations expand, *Dynamics'* modules deliver incremental upgrades in functionality for an affordable $500 each. As a result, you end up paying for advanced capabilities only when you need them.

Although single users can access *Dynamics*, it's designed for a LAN. The basic System Manager permits four simultaneous users and will keep the books for four companies.

The program, now in limited release, will be generally available in the first quarter of 1993. It will eventually include about 35 modules and will support *Windows*, Windows NT, and the Apple Macintosh.

—Richard Morochove

Dynamics

WINDOWS The hallmark of this high-end *Windows* accounting package is flexibility. You buy only what you need, and you can modify almost anything.

Great Plains Software
800/456-0025
List price: $500 per module
Reader service no. 611

One portable Valitek backs up all your PCs!

No controller cards needed!

- 100% compatible with virtually all PCs
- Proven transfer rates up to 6.0 MB per minute
- The only tape backup that works on both parallel and serial ports
- No formatting required; Formats/writes/verifies in one pass
- Easy-to-use software makes our manual almost unnecessary
- 60, 160, 250MB models
- Software runs on one 360KB floppy
- Extensive hardware error checking

PC WEEK LABS ANALYST'S CHOICE Oct. 15, 1990 PST-160

CHIP PRODUKT DES MONATS Feb., 1991 PST-160

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VALITEK

Circle 224 on reader service card

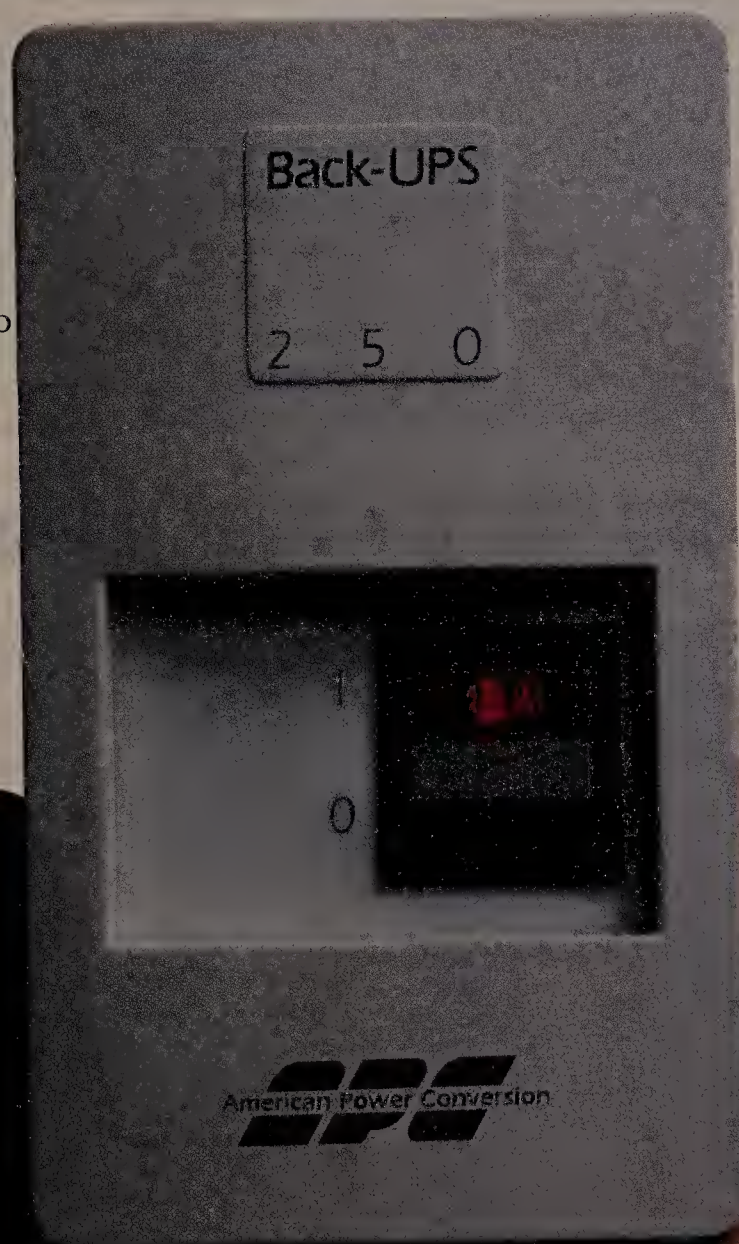
Get a hold of the best value in LAN power protection

Now just $139!* suggested list price

Blackouts, brownouts, sags... Your data and hardware are vulnerable to problems that surge suppressors and power directors are just not equipped to handle.

Now there's a complete Uninterruptible Power Supply solution to suit any budget. The Back-UPS™ 250 is reliable protection for LAN nodes, 386SX machines, 286, small PS/2 systems, and internetworking hardware such as routers, bridges, gateways and repeaters.

From the largest server to the smallest router, the Back-UPS Series will increase your productivity by providing a cost-effective solution to power problems. Call for your free power protection handbook.



The **Back-UPS 250** offers even more cost-effective protection for LAN nodes (typical runtime for a 386SX system is 10 minutes).

NEW!

Guaranteed ABSOLUTE™ Protection

- ABSOLUTE™ Protection guarantees repair or replacement of equipment (up to $25,000) if damaged by a surge while protected by a properly installed Back-UPS (See warranty for details).
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- Ask about PowerChute® UPS monitoring software and Novell compatible UPS monitoring boards
- 230V models available

LAN TIMES READERS CHOICE 1992

Computer Reseller News Editors' Choice

1991, 1990

Model	Application	List	New List
Back-UPS 250	LAN nodes, 386SX, 286, internet hardware, POS	~~$169~~	$139
Back-UPS 400	Desktop 386, 486 systems, 286 servers	~~$249~~	$229
Back-UPS 450	Tower 386, 486 systems, servers	~~$329~~	$279
Back-UPS 600	Heavily configured systems, CAD/CAM workstations	~~$449~~	$399
Back-UPS 900	Multiple systems, longer runtime applications		$599
Back-UPS 1250	Multiple systems, LAN hubs, small minis, telecom equipment		$799

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rcle 45 on reader service card

DrivePro Utility Offers Easy Alternative to DOS Hard Drive Installation

If you've ever installed and set up a new hard disk, you know what an intricate, tricky operation that job can be. The experts at Micro House have a treat for you with *DrivePro*, a program that makes the process practically foolproof.

To start the hard disk installation, you select your drive from *DrivePro*'s comprehensive list of technical specifications for over 1900 drives (all PC drives since 1984).

In the unlikely event that your disk isn't on their list, *DrivePro* will retrieve the specs (such as make, model, cylinders, heads, sectors, and mean time between failures) directly from IDE, ESDI, and SCSI drives.

On most drives, the program can eliminate the need to use DOS's DEBUG by locating the controller's on-board firmware, perform a low-level format—or nondestructive low-level format—and determine the optimal interleave. *DrivePro*'s partition table creator and editor is easier to use than DOS's FDISK and offers more options. For example, you can let *DrivePro* partition your disk automatically.

If you have more than one operating system, you can select Multi-Boot MBR to have the program ask which bootable partition—or drive—you'd like to boot from. If you use another option, *DrivePro* writes the drive parameters directly onto the drive. This will allow you to remove the controller card and drive and install them in any other computer, bypassing the computer's CMOS. *DrivePro* will also save your precious CMOS, FAT, and partition tables to disk for added safety.

For the ambitious user, the program comes with Super Sector Editor, which, like Norton's Disk Edit, lets you edit sectors on the disk.

The $129.95 *Drive-Pro* works with ESDI, IDE, SCSI, and ST506/412 (MFM) interface types and comes with a useful 182-page manual.

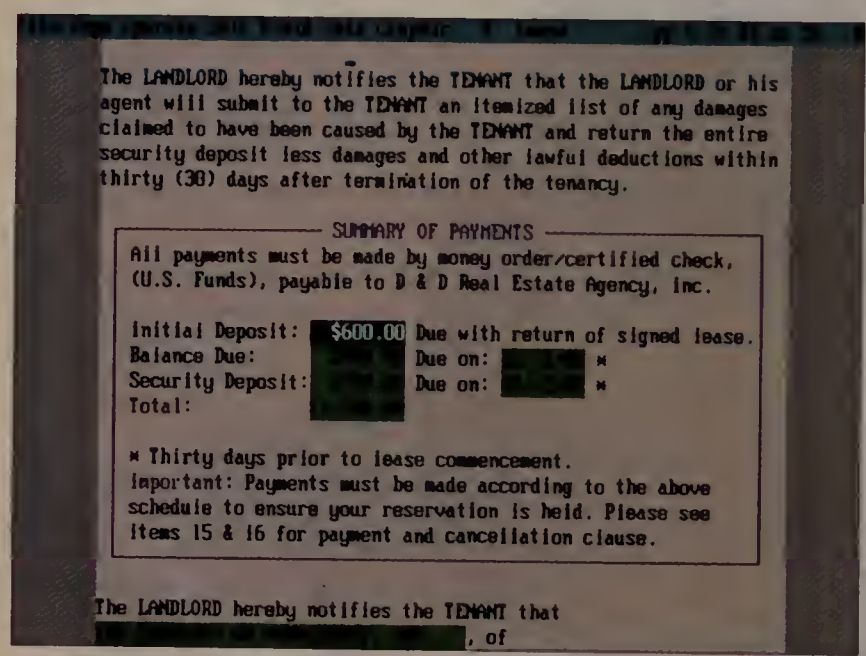
—Steve Bass

DrivePro

This practical utility helps you install new hard disks without using DOS's DEBUG, FDISK, or FORMAT commands.

Micro House
800/926-8299,
303/443-3323 (fax)
List price: $229.95
Reader service no. 612

Shareware Word Processor With Spreadsheet and Database Functions



Priced at only $69, Surefire gives you spreadsheet and database functionality along with some word processing tools.

Piaf, Inc., calls its *Surefire* a "smart document processor." This year's Shareware Industry Awards named it "Best New Product." At first glance, *Surefire* appears to be a low-end word processor. But if you look at the feature list, it's more like a small integrated program. Whatever else *Surefire* is, it's a bargain, costing only $69, and that's only after you've tried it out and decided to keep it.

What makes *Surefire* documents "smart" is their ability to incorporate spreadsheet and database functionality. You can place text and numeric fields anywhere within a document, and in some of these fields, you can place formulas that read other fields and make use of *Surefire*'s more than 70 functions. The result: a spreadsheet merged into a word processor. What's more, a few quick definitions turn your document into an entry form for a database that you can search, query, and design reports for. It's like letting your database grow out of your word processor's mail merge program rather than the other way around.

So how can you lose with this $69, try-before-you-buy integrated program? For one thing, you don't get the world's most powerful word processor. In fact, many features you've come to expect even in executive word processors are missing. There's no spelling checker or thesaurus, and font support is about as minimal as it gets (you're allowed one font per document, and proportional fonts aren't supported).

Surefire is available through most shareware distribution outlets, including PC World Online. You'll find the program as SUREFI.ZIP, the documentation as SFDOC.ZIP, and a demo tutorial as SFDEMO.ZIP. *Surefire Contacts*, a contact manager that runs under *Surefire*, is available as SFCONT.ZIP and costs $19 if you decide to use it.

—Lincoln Spector

Surefire 1.5

✓SHAREWARE This inexpensive "integrated" program puts all of its features in a word processor so you don't have to jump from module to module.

Piaf, Inc.
303/786-8222
List price: $69
Reader service no. 613

The Best Way To Send, Receive and Manage Faxes in Windows.

Includes FREE Cover Your Fax™ Software ($39.95 Value)

Announcing WinFax PRO 3.0

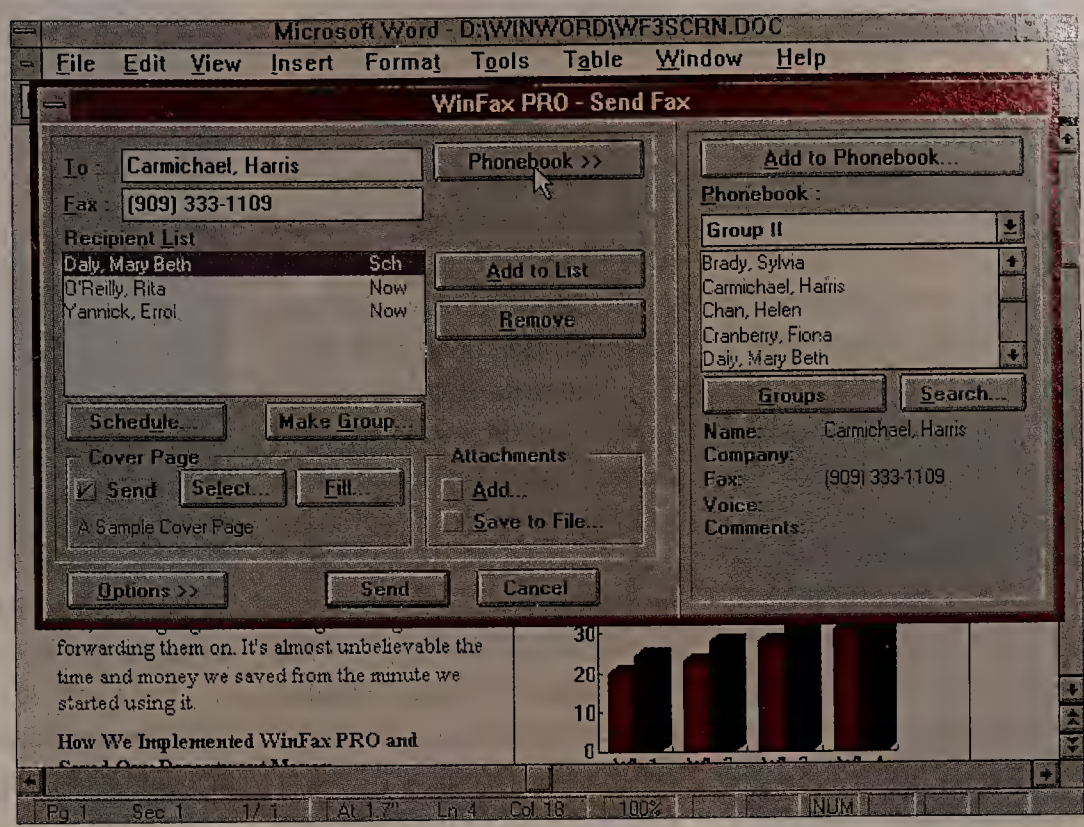
PC Magazine gave WinFax PRO 2.0 its prestigious *Best of 1991* award. But we didn't stop there. New WinFax PRO 3.0 is even more powerful, offering you the highest level of performance in sending, receiving and managing faxes.

Powerful Tools To Manage Your Faxes

WinFax PRO 3.0 puts the complete range of advanced faxing tools at your fingertips, all integrated into one powerful solution. With WinFax PRO 3.0 you can "one button" fax from any Windows application to any fax machine in the world. You can combine documents from multiple Windows applications into a single outgoing fax, including scanned documents. And, the phonebook provides advanced searching and group creation, using standard dBASE file formats. Plus, you can broadcast faxes to groups of individuals with just a few simple clicks.

WinFax PRO 3.0's document management tools enable you to file, track and quickly find faxes you've sent or received. Plus, you can markup any faxed document with text and graphics, using our fully-featured annotation tools. We've also included AnyFax™, the industry's most advanced OCR software for fax documents, so you can convert faxes into editable files for your word processor or spreadsheet.

PLUS, as a special introductory offer, WinFax PRO 3.0 contains Cover Your Fax™, over 50 unique cover sheets designed by nationally syndicated cartoonist John Caldwell. Perfect for your business or personal use, and suitable for any situation. **A FREE $39.95 value, for a limited time only.**



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"The best faxing software money can buy." *Preston Gralla, PC Computing*

"If you're looking for fax software, get anything with Delrina's name on it." *John C. Dvorak, Syndicated Columnist*

"WinFax... a small software miracle." *Alfred Poor, PC Magazine*

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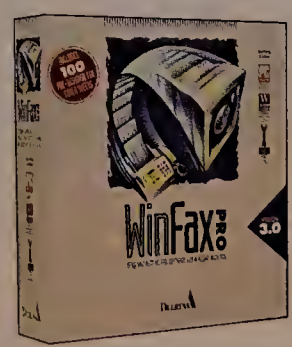
1-800-268-6082 TODAY



BEST OF 1991
WinFax PRO 2.0

ANNUAL WIN AWARD
WinFax PRO 2.0

Software For Improved Office Performance

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Circle 61 on reader service card

Motorola's Versatile Radio Modem Does Double Duty

Motorola's InfoTAC is a 1-pound portable wireless radio modem that lets you send and receive E-mail from your PC, whether you're stuck at the airport or racing to a meeting in a cab.

InfoTAC has a few tricks up its sleeve that distinguish it from its main competitor, Ericsson GE's Mobidem. It's really two devices in one: a radio modem that hooks up to a portable PC; and a stand-alone two-way messaging tool with a 4-line, 20-character LCD screen. Even without a PC, you can receive E-mail with InfoTac, read the message, and then touch a button to fire off a brief canned response that you create beforehand with your PC and then transfer to InfoTAC by way of the serial port.

InfoTAC's 10K RAM buffer can store dozens of incoming messages, each up to 512 characters. The $1350 device exchanges data via Motorola's Ardis or Ram Mobile Data's Mobitex packet-switched networks at speeds of 4800 bits per second (bps) and 8000 bps, respectively.

Motorola officials say InfoTAC will support Ardis's next-generation protocol, which will transfer data at up to 19,200 bps. And users will be able to download future high-speed protocols to the radio modem's

InfoTAC

Motorola's wireless radio modem sends and receives E-mail from almost anywhere.

Motorola Mobile Data Division
800/247-2346,
206/483-3400 (fax)
List price: $1350
Reader service no. 615

Motorola's 1-pound InfoTAC wireless radio modem operates as either a two-way messaging device or as a radio modem.

Sales manager Susan Briggs has innovative ideas. But you'd never know it when she only has an hour to prepare.

flash ROM, thanks to Motorola's digital signal processor, which is flexible enough to handle software upgrades.

InfoTAC will operate up to 8 hours in power saving mode, Motorola claims. It's compatible with Hayes's AT-command set, allowing you to use standard communications packages with the radio modem. And InfoTAC's case includes a flip-up antenna to help you connect to the network when you're in an area of spotty coverage.

InfoTAC is great for sending short E-mail messages but too slow and costly for transmitting huge data files and faxes. For instant E-mail, though, InfoTAC's price may be worth it.

—Jeff Bertolucci

OnTime: Better This Time With E-Mail Compatibility

The unending hassle of rounding up busy colleagues for meetings is one of those immutable facts of business life. Fortunately, several companies—now including Microsoft—offer group scheduling packages that integrate with E-mail, so setting up meetings becomes less maddening.

OnTime, a longtime favorite among personal scheduling packages, has been available in both DOS and *Windows* network versions since 1990. Former versions of the product allowed users to view their colleagues' schedules, create to-do lists, and set up meetings. The new version, *OnTime for Networks*, adds the ability to receive notification about meetings directly through *OnTime* or through E-mail packages with MHS compatibility, such as *Beyond Mail*, *Da Vinci*, *cc:Mail*, and *Microsoft Mail*. The advantage? You'll be notified about meetings even if you don't have *OnTime* up and running. However, you'll need to load *OnTime* to respond to the message.

A host of new features is certain to please meeting organizers. The RSVP function allows attendees to respond instantly to meeting requests with an answer of 'yes', 'no' or 'pending' (meaning "I'll have to get back to you"), so organizers can confirm the list of attendees before the meeting occurs.

You can now attach personal notes to individuals or send and modify memos to entire lists of attendees. If you want to delete old items, you can do so within specified date ranges.

—Bronwyn Fryer

OnTime for Networks

WINDOWS A beefed-up version of the group scheduling package lets you respond immediately to meeting requests and notifies you about meetings via E-mail.

Campbell Services, Inc.
800/345-6747,
313/559-1034 (fax)
List price: three-user DOS version $297, three-user *Windows* version $356
Reader service no. 614

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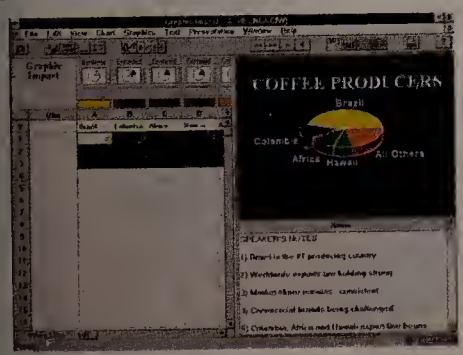

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Circle 127 on reader service card

Hot Off the Wire: MCI Mail Gets Windows Front End

MCI Mail is a handy way to reach out and touch someone electronically or send faxes, but the interface looks as if it was designed during the Eisenhower administration. Swfte is dragging MCI into the 1990s with *The Wire for MCI Mail*, a slick $99.95 *Windows* front end.

The Wire lets you exploit all MCI services to send messages easily by MCI, other mail systems, fax, telex, or U.S. mail. In its friendly desktop environment, messages are stored as letters within folders, and you can click on many basic commands via an icon bar on the top of the screen. You can customize your individual address book and speed your mail by creating named lists of recipients or even "iconizing" anyone whom you contact frequently.

Swfte worked with MCI to let you send binary as well as text files without hassles to anyone else outfitted with *The Wire* and certain other communications packages—notably, the Macintosh's *Desktop Express*. *The Wire*'s Suitcase feature keeps your mail and address book in sync among your desktop, home, and portable PCs.

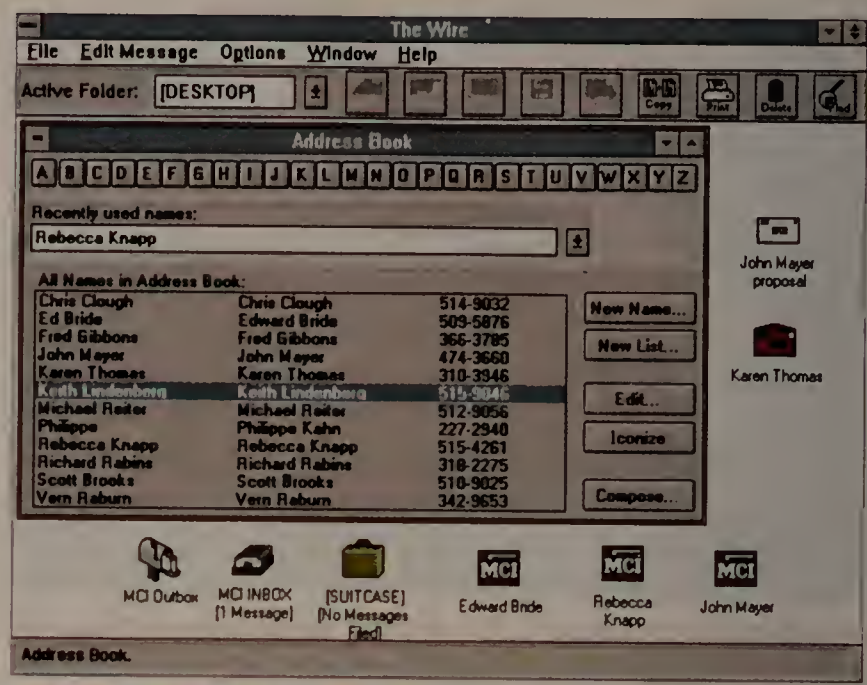
If you receive most of your messages on MCI, you can instruct the Scheduler to automatically call the service at 1-, 4-, or 24-hour intervals.

—Eric Bender

The Wire for MCI Mail

A slick front end for MCI Mail helps bring the communication service's interface into the modern world.

Swfte Int'l
800/237-9383,
302/234-1760 (fax)
List price $99.95
Reader service no. 616



The Wire for MCI Mail lets you customize your address book and speed mail delivery by creating icons for recipients you contact frequently.

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THE LASER – SHARP, BUDGE

LAN Adapter Shrinks Down to Credit Card Size

Compact, pocket-size LAN adapters make it easy to hook up your portable PC to the office LAN. Now manufacturers like Xircom are making LAN-to-notebook connections even easier by offering adapters the size of credit cards.

Xircom's new CreditCard Ethernet Adapter lets you link to a LAN via the tiny PCMCIA 2 slots found in the latest generation of notebook and handheld PCs. To install the adapter, you simply insert it in the slot and then install the appropriate network software driver.

Mobile professionals will appreciate the card's tiny size, but since it's about four times as thick as a credit card, plan on carrying it in your shirt pocket, not your wallet.

The adapter supports Novell's NetWare, Artisoft's *Lantastic*, DEC's *Pathworks*, Microsoft's *LAN Manager*, and other network operating systems. Xircom officials are planning versions of CreditCard that will support token ring and Arcnet networks.

The Xircom card's 16-bit interface offers performance comparable to that of a 16-bit AT-bus card, or a maximum of 8MB per second, Xircom claims. Two LED lights located on the edge of the card let you monitor usage; for example, you can check whether the card is turned on or whether it's sending and receiving information to and from the network.

A computer connected to a LAN typically has an AC outlet nearby, so battery conservation isn't crucial for PCMCIA LAN adapters. Nevertheless, the CreditCard's power management software can turn off certain parts of the adapter that aren't in use, such as the LED status lights, the transceiver—or even the entire card itself. The percentage of battery power that CreditCard draws from a notebook depends on the machine's design (and power management among notes varies greatly).

The PCMCIA slot standard allows users to mix a variety of PC cards, including LAN adapters, fax-modems, wireless communications, and storage. A raft of vendors will have introduced these cards by year-end, giving users a wide selection. Analysts believe that over time, the cards may even replace expansion slots on desktops.

Exact pricing for the CreditCard Ethernet Adapter wasn't set at press time, but Xircom officials say it will cost about the same as the firm's $445 external Pocket Ethernet Adapter II.

—Jeff Bertolucci

CreditCard Ethernet Adapter

One of the first PCMCIA-compatible LAN adapters provides a lightweight way to link a notebook to a network.

Xircom
800/874-7875,
818/878-7630 (fax)
Estimated list price: $445
Reader service no. 617

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WINDOWS Once you've got your data, can you make it look sharp—without devoting big bucks and long hours to the job? Alpha Software's *Report Styler* may be just the tool you need. When you bring *dBASE*, *Paradox*, *Excel*, or ASCII files into *Report Styler*, you're presented with a WYSIWYG view of your report that you can manipulate at will. Move a field or change a font in the first record, and all the other records change accordingly. You can set up a report to have multiple columns, add boxes or lines, and adjust colors. When you save a report, you're essentially saving the formatting rules and a pointer to a file. Update your data, and you've got an updated report. *Report Styler* is expected in the fourth quarter; its list price will be $199. Alpha Software, 800/451-1018, 617/272-4876 (fax).

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Reader service no. 628

MediaBlitz

Asymetrix's new low-priced utility lets object-oriented programmers point-and-click their way to a multimedia slideshow. The $95 *MediaBlitz* includes three applets. The first is Clipmaker, which you use to capture clips from various devices including CD ROMs, CD Audio, animation packages, wave audio, and MIDI devices. You set up the presentations with ScoreMaker, which provides a graphical time line marked off in seconds to allow you to arrange clip files by simply dragging and dropping. The scores are saved in text files; you can later play them back with ScorePlayer by clicking on their icons. Asymetrix bundles more than 4MB of multimedia clip files—wave sounds, animation, MIDI clips, and bit maps—and users receive an additional 6MB free when they register. Asymetrix Corp., 800/448-6543, 206/462-0501, 206/637-1504 (fax).

Reader service no 624

FontMinder

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The $70 NoteLock hooks inside your notebook to protect it from prying eyes. An anchoring cable (not shown) guards against theft.

This process also works with font packs—collections of fonts you create yourself. For added convenience, the $79.95 *FontMinder* comes with a TrueType viewer, so you can see what a font looks like before you install it. Ares Software Corp., 800/783-2737, 415/378-8999 (fax).

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Reader service no. 619

The SCSI Master Plus

If you're thinking about adding SCSI devices to your computer, consider this useful addition: Adaptec's new $214 SCSI Master Plus host adapter kit. The product is designed to make installation easy. The AHA-1542C adapter comes with a built-in 10-MHz processor to reduce SCSI overhead transfer time, and it also includes software drivers for DOS, *Windows*, NetWare, OS/2, and UNIX. It supports flopticals, WORM drives, rewritable optical drives, QIC tape drives, CD ROM, and hard disks. A forthcoming utility, *EZ SCSI*, will make installation even easier by supplying menu-driven prompts. Adaptec, 408/945-8600, 408/262-2533 (fax).

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AOX StaX SX 25 MHz, MicroMaster 486SX

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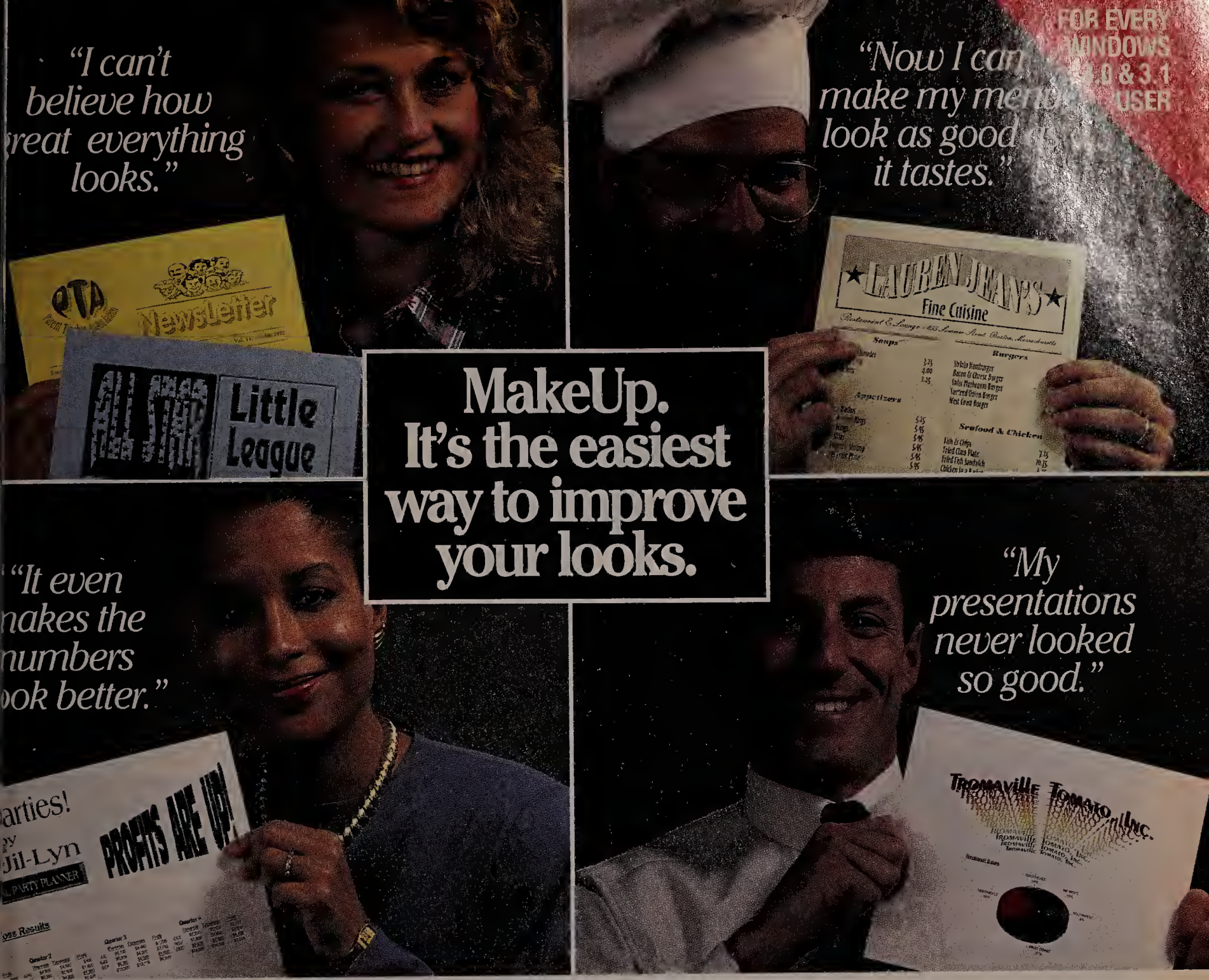

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MakeUp supports Microsoft Windows 3.0 and 3.1, and most Windows-compatible printers. It exports images to Windows and non-Windows applications and supports object linking and embedding in Windows 3.1. Plus it provides access to over 16 million colors, including the Pantone Matching System®.

You'll find MakeUp at your favorite computer retail store. Or call **1-800-522-FONT** for the name of a store near you.

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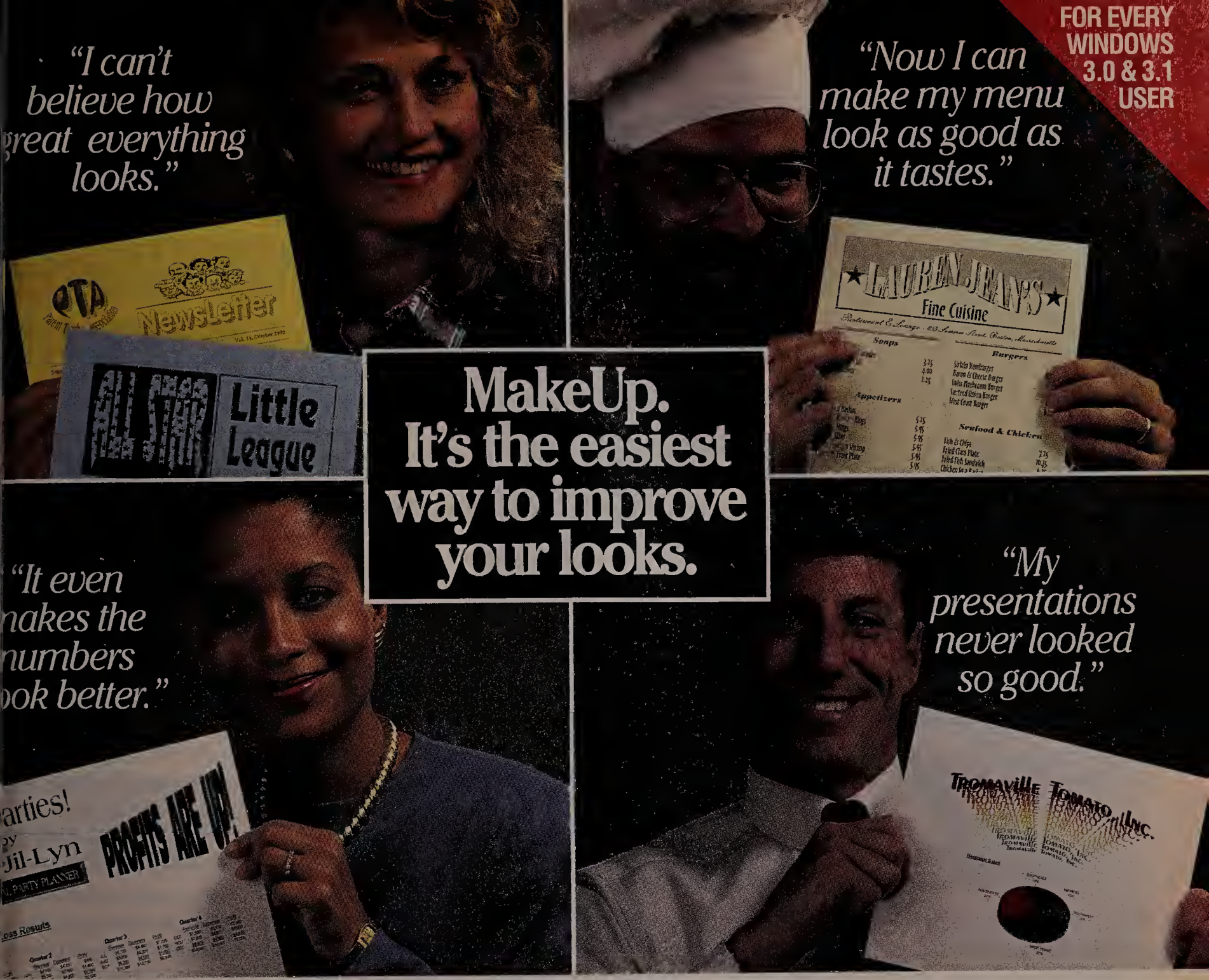

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a 25-MHz 486SX processor upgrade that supports an impressive array of PS/2s: Models 50, 50Z, 55, 56, 57, 60, 65, 70, and 80. This board can use existing system memory, or up to 16MB of 32-bit RAM on the upgrade board, and you can make it even speedier by adding Intel's clock-doubling OverDrive chip. The StaX 25 MHz lists for $495; the MicroMaster 486SX 25 MHz is $1600. AOX, Inc., 800/232-1269, 617/890-4402.

Reader service no. 620

Action 2.0

WINDOWS *Action 2.0* is a multimedia presentation package that now comes with MIDI sound support, a run-time player, and sophisticated import capabilities. If you've created a presentation in a *Windows* program, you can easily import the file into *Action* in one fell swoop, add sound and motion, and even animate *Excel* charts. As with the previous version, you can sequence animation and sound and change the order and duration of events on an interactive time line. *Action 2.0*'s Player application lets you show your presentation on any *Windows*-equipped computer, even if it doesn't have *Action 2.0*. List price is $495; *Action 1.0* owners can upgrade for $79, or free if they purchased it after May 1, 1992. Macromedia, 800/288-4797; 415/442-0190 (fax).

Reader service no. 629

E-Mail Connection, Font Connection, Clip Art Connection

WINDOWS On-line services are becoming increasingly powerful. Three new services from Connect Software actually take charge of your local E-mail and make it easier to shop for fonts and clip art. *E-Mail Connection* collects your messages from MCI and CompuServe (more services will be supported later) and your LAN E-mail system and stores them in one place, where you can access them via one handy *Windows* interface. *Clip Art Connection* and *Font Connection* let you shop from within *Windows*. If you're looking for a particular font, type its name into *Font Connection*'s search field, or browse till you find one you like. It searches a catalog of over 1000 TrueType fonts and displays sample characters. Make your choice—a whole family or just a single typeface—click on the dollar sign, and *Font Connection* dials up, downloads, charges your credit card, and updates your library. *Clip Art Connection* works in much the same way. *E-Mail Connection* is $89.95 until the end of December, $249 thereafter. *Font Connection* lists for $29.95, and *Clip Art Connection* lists for $19.95. There are no on-line fees. Connect Software, 800/234-9497, 206/869-0252 (fax).

Reader service no. 621

Trak101 Trackball

The Trak101 is a $224, 101-key keyboard that uses an on-board trackball to emulate a mouse. *Windows* and CAD users will especially appreciate its flexibility. The device allows three forms of button use: one-handed (using the four buttons on the trackball or putting the thumb on the trackball and using the numeric keypad keys as buttons) or two-handed (using the right thumb on the trackball and the left <Ctrl> and <Alt> keys as buttons). To minimize dragging and rotating, one of the trackball's buttons provides a drag-lock function so you can

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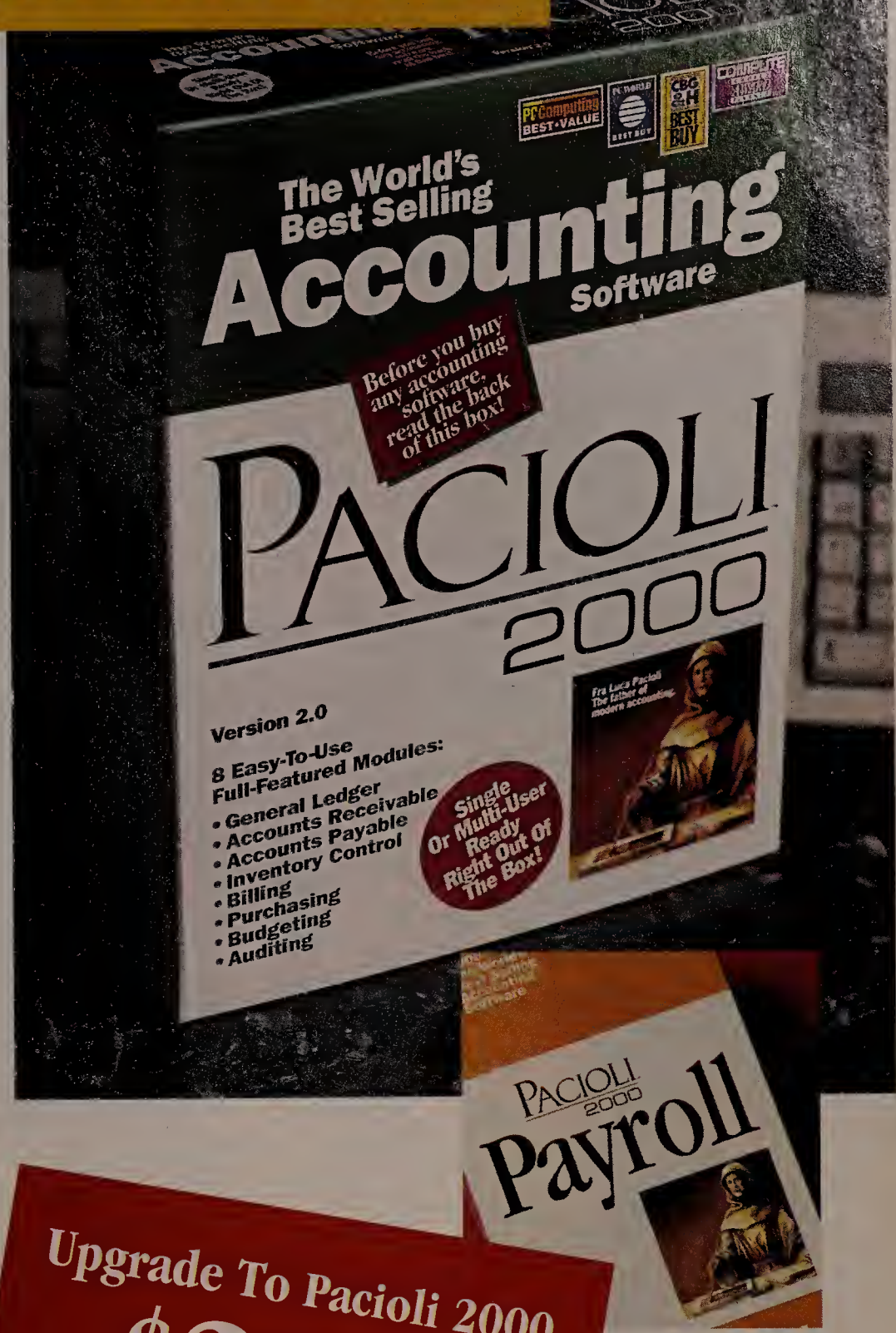

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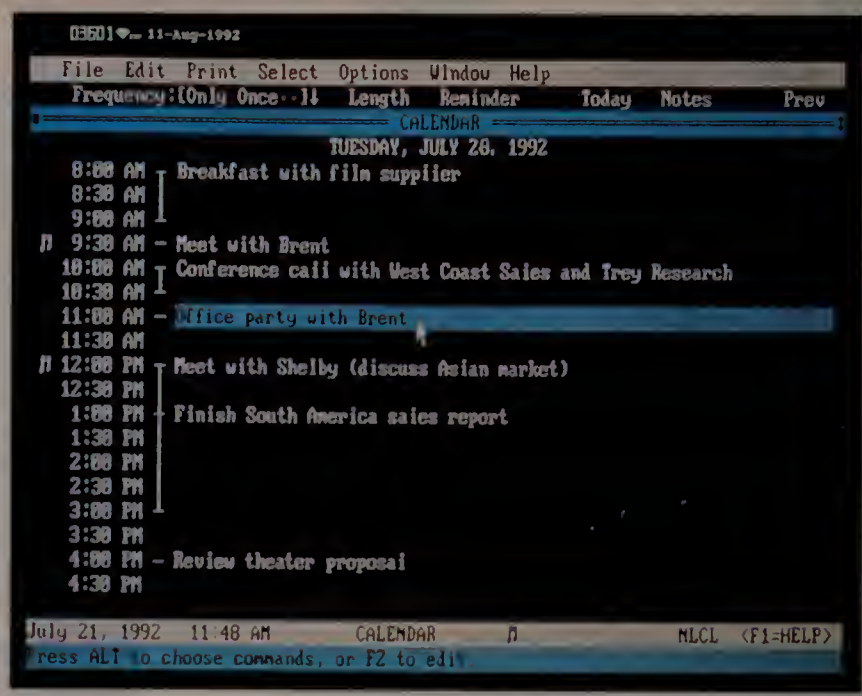

Microsoft Works 3.0, a many-faceted integrated program, now includes a calendar module to keep you on schedule.

simply point to both ends of whatever you want to select. Another button allows for auto-acceleration, a mode that is especially useful for users with large screens who also need precision. The Custom Key Feel Kit is a $15 option that enables users to give their keyboards one of four different feels. Key Tronic Corp., 800/262-6006, 509/927-5224 (fax).

Reader service no. 627

QBlazer

QBlazer is a tiny portable modem, measuring just 2.3 by 2.4 by 2.4 inches, that screws onto any serial port. Telebit is now selling the modem direct to customers at a considerable discount—$299, or 50 percent off the $599 list price. (The modem is also available through Telebit's dealer channels.) With its V.32 protocol support, QBlazer offers data throughput of 9600 bps; combined with V.42-bis data compression and V.42 error correction, the modem offers theoretical transfer rates of over 38 kbps. Telebit Corp., 800/835-3248, 408/734-4333, 408/734-3333 (fax).

Reader service no. 623

Microsoft Works 3.0

Version 3.0 of this integrated word processor, spreadsheet, communications package, database, and drawing program has joined the ranks of graphical DOS programs. It now offers dialog boxes, toolbars, and color text. It also boasts a new calendar module. Spreadsheets can now be 16,384 rows by 256 columns; databases can be increased to 32,000 records and are *dBASE* compatible. The communications package supports more protocols (YMODEM, ZMODEM, XMODEM, and KERMIT) and allows you to plug into COM 3 and COM 4. The word processor can do footnotes and import graphics, and it comes with its own clip art. *Works* retails for $149, and you get *Flight Simulator* free if you purchase before January 31, 1993. Upgrades from version 2.0 list for $49.95. Microsoft Corp., 800/426-9400, 206/936-7329 (fax).

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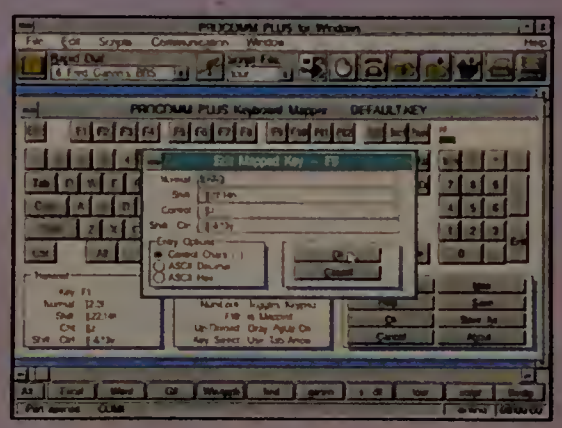

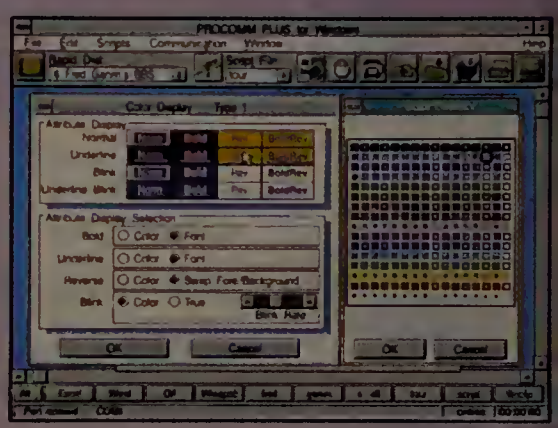

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Marketplace

Price Information to Make a Smart Buy

Over the Counter

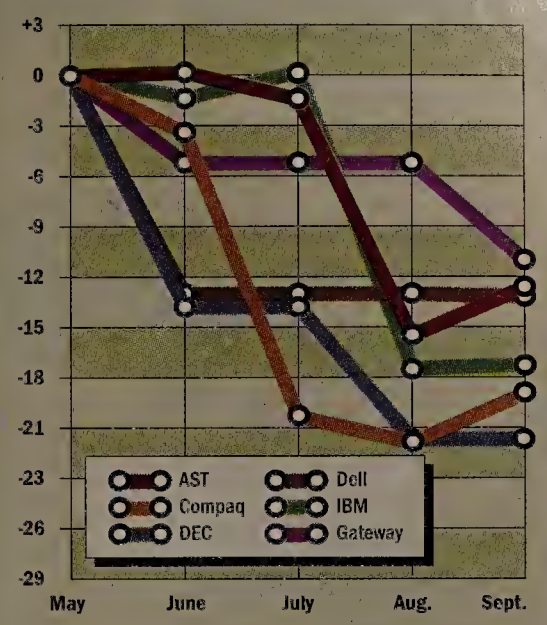
What you pay at retail stores for popular PCs

	Configuration			National	
	CPU/speed (MHz)	RAM (MB)	Hard disk (MB)	List	Average
386SX/SLC-based desktop PCs					
AST Power Premium 3/25s	i386SX/25	2	80	$1845	$1586
Compaq ProLinea 3/25zs	i386SX/25	2	84	$999	$900
Dell System 325SX	i386SX/25	2	52	$820	$820
Gateway 2000 25MHz 386SX	i386SX/25	4	80	$995	$995
IBM PS/2 Model 56 SLC	386SLC/20	4	80	$2485	$2021
IBM PS/2 Model 57 SLC	386SLC/20	4	80	$2795	$2262
NEC PowerMate SX/25i	i386SX/25	2	60	$1549	$1302
386DX-based desktop PCs					
AST Power Premium 3/33	i386DX/33	4	210	$3095	$2672
Compaq Deskpro 3/33i	i386DX/33	4	120	$1979	$1793
Compaq Deskpro 386/33M	i386DX/33	4	120	$2569	$2287
Dell System 333P	i386DX/33	4	230	$1600	$1600
Hyundai CS-386/40	Am386DX/40	4	120	$1730	$1730
NEC PowerMate 386/33i	i386DX/33	4	120	$2049	$1735
486SX-based desktop PCs					
AST Power Premium 4/25s	i486SX/25	4	210	$2995	$2571
Compaq Deskpro 486s/25M	i486SX/25	4	120	$2569	$2262
DEC DECpc 425sx LP	i486SX/25	4	245	$1849	$1849
Dell System 486D/25	i486SX/25	4	200	$1920	$1920
Gateway 2000 25MHz 486SX	i486SX/25	4	200	$1570	$1570
486DX-based desktop PCs					
AST Power Premium 486/33	i486DX/33	4	210	$3495	$3001
Compaq Deskpro 486/33M	i486DX/33	4	340	$3869	$3408
Compaq Deskpro 50M	i486DX2/50	8	340	$4469	$3963
DEC DECpc 466d2 LP	i486DX2/66	4	120	$2199	$2199
Dell 486D/66	i486DX2/66	8	230	$2850	$2850
Gateway 2000 +66MHz 486DX2	i486DX/33	8	340	$2425	$2425
IBM PS/2 Model 90 XP-0KF	i486DX2/66	8	400	$6915	$5553
IBM PS/2 Model 90 XP-0LF	i486DX2/50	8	400	$7415	$5887
NEC PowerMate 486/50i	i486DX2/50	4	240	$2949	$2456
Portable PCs					
AST Premium Exec 386SX/20	i386SX/20	2	40	$1395	$1235
AST Premium Exec 386SX/25	Am386SXL/25	4	80	$1895	$1707
Compaq LTE Lite/20	i386SL/20	2	60	$2499	$2301
Compaq Portable 486c	i486DX/33	4	120	$8699	$7626
Dell Dimension NL25	i386SL/25	2	80	$1849	$1849
Gateway 2000 Nomad 420SXL	i486SX/20	4	80	$2495	$2495
Hyundai Super-NB386S	i386SX/20	2	60	$1349	$1349
IBM PS/2 Model N51 SLC	386SLC/16	2	80	$2265	$1944
NEC UltraLite SL/20	i386SL/20	2	80	$2199	$1855
TI TravelMate 3000WinSX	i386SX/20	4	60	$2599	$2066
Toshiba T3300SL	i386SL/25	2	80	$2899	$2535
Toshiba T4400SX	i486SX/25	2	80	$3399	$2941
ZDS Z-Note 325Lc	i386SL/25	4	120	$4689	$4689

From a national survey of more than 180 dealers by International Data Corporation. Figures are based on at least four price quotes for each machine. Prices are based on manufacturer's standard configuration without monitor.

Trend Line: After the Cuts, Prices Firm Up

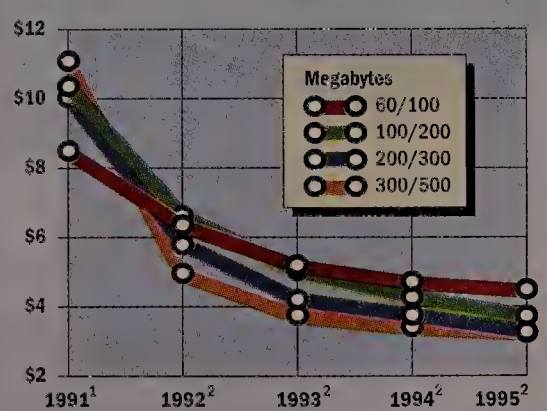
Percent decrease in system price based on a sampling of street prices



PC companies have slashed prices across the board, bringing a sharp drop in street pricing. In fact, the change in pricing structure is more dramatic than shown—companies including Compaq, Dell, and AST have introduced lines of low-cost PCs during the summer. Strong demand for these new lines led to product shortages that helped firm up prices.

More for Less: Hard Drive Costs Keep Falling

Cost per megabyte of storage for 3½-inch hard drives based on average street prices



Hard disk prices are lower than ever, but don't expect your next drive to cost less than your current one. Disk-hungry programs such as Excel, Windows, and OS/2 are forcing users to invest more and more in storage. With upcoming applications expected to demand even greater amounts of disk space, buyers will still be spending more on larger drives, despite falling prices.

[1]Actual. [2]Forecast.

Source: 1992 Disk/Trend Report from Disk/Trend Inc

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THE READERS' CHOICE

WORLD CLASS 1992

Now that the elections are over, it's time to focus on more important things—like PC World's tenth annual World Class Awards.

STEVE LYONS

The polls are closed, the ballots have been counted, the people have spoken. And they've elected a slate of candidates to the most prestigious positions in the land. We're not talking about George and Dan or Bill and Al—we're talking about Hewlett-Packard, WordPerfect, Microsoft, and the other winners of *PC World*'s tenth annual World Class Awards.

For ten years we've been polling our readers for their favorite hardware and software products—the longest-running free elections in the history of the PC industry. And for ten years our readers, free from the scowls of jaded editors or the bluster of marketing hypesters, have given us the skinny on the products *they* feel are worthy.

This year we asked our readers to fax us the names of their favorites in 42 categories, from the top desktop PC to the most useful utility. As always, their responses provide sharp insights into the industry and where it's headed. You'll find the complete list of winners and runners-up on the following pages, as well as the names of three lucky readers who won a slew of World Class products (see "Luck of the Draw").

by Daniel Tynan

To honor World Class's first decade, we've taken a historical perspective, offering a look back at the vendors who've proven the most consistent World Class performers over the

years, as well as the Young Turks who threaten to overthrow them. We've sliced and diced the vote totals in a variety of ways in order to provide new insights on the forces shaping the industry. Finally, we've called upon a panel of expert analysts to dig beneath this year's tumultuous shifts and changes to unearth the hidden trends in key categories as well as to forecast what they see coming down the road. Combine their analyses with our readers' list of winning products, and you'll have an unbeatable shopping guide for 1993 and beyond.

Hardware

When it comes to hardware, the mood of the *PC World* electorate can be summed up in one word: change. Eight of 1992's 18 hardware categories boast first-time winners. Perennial front-runners like the Hayes Smartmodem and HP's ScanJet were swept out of office—in part because their natural constituencies were split between multiple product lines. But the most dramatic changes came in desktop computers and transportables, as voters gave a strong thumbs up to low-cost 486s and threw their support behind the most colorful candidates.

Luck of the Draw

Our readers fill out the World Class ballots for two reasons: to make their voices heard and—with a little luck—to win some great prizes. Three voters whose names were drawn at random accomplished both goals. Our third-prize winner is now the proud owner of the award-winning notebook computer, along with the winning dot matrix printer, the winning modem, a carrying case and battery pack, and five software packages of his choice, worth $8350. The second-prize winner gets the World Class portable computer, the top ink jet printer, a modem, a scanner, and ten new software packages, totaling $14,300 in value. And the grand-prize winner takes home the winning desktop and notebook computers as well as the top laser printer, a scanner, a modem, and 15 software packages—worth a total of $27,000.

Grand-Prize Winner:
Brad Wiesley

Brad Wiesley was amazed to win a Gateway 2000 486/33, a Toshiba T4400SXC notebook, plus the other winning hardware and software products. "I've never won anything in my life," he explained to us. A 33-year-old police officer for the city of Lafayette, Colorado, Wiesley is also owner of a police training firm. He currently uses a 33-MHz 386 clone on which he runs mostly *Windows* applications. Before winning our grand prize, he had been thinking about purchasing a notebook computer to help him make presentations, but now his checkbook is safe. "I'll be able to use the notebook for live overhead presentations when I'm training other officers," he says. Having used his PC on CompuServe in the past to organize ski trips, Wiesley claims, "This is going to make life even more fun."

Second-Prize Winner:
Philip Staite

Asked if he'd ever won anything before, Philip Staite, a 28-year-old electronics engineer for the Navy, replied, "No, except for the affections of my wife." Staite, who's worked with PCs since 1985, runs *Windows*, *WordPerfect*, and programming tools on his slower-than-molasses 12-MHz 286 home computer. His new Compaq portable 486C will "make all the difference in the world," he says. Staite is working toward a master's degree in computer science and says his new computer will come in handy for writing research papers.

Third-Prize Winner:
Brian Krieger

Luck has smiled more than once on Brian Krieger. A 28-year-old systems analyst with Safeco Insurance in Seattle, Krieger once won a trip to San Francisco in a store drawing. It smiled again when he won the Toshiba T4400SXC notebook. Krieger, who currently runs *Windows* and a variety of programming packages at work on a 50-MHz 486 and a 25-MHz 386, began playing with a Commodore 64 when he was in college. Today, he's busy perfecting his desktop publishing skills.

LEFT TO RIGHT: RAY KO; KATHERINE LAMBERT; MATTHEW MCVAY

Desktop Computers: Gateway to Heaven

We knew there would be a three-way race somewhere this year, but we didn't expect it to be for top desktop computer. Yet when the ballots were counted, dark-horse candidate Gateway 2000 had galloped to a stunning victory over the five-year incumbent (Compaq) and the heir apparent (Dell). Gateway not only captured the title for best desktop, it also got the nod for best service and support and ranked in the top five for portables, notebooks, most promising newcomer, and best mail-order firm.

Word for Windows may have captured the hearts and minds of many PC World readers, but WordPerfect still commands their wallets, with more than 46 percent of United States unit sales.

Like Compaq's triumph over IBM in 1987's World Class contest, Gateway's victory represents a changing of the guard—this time from high-ticket systems dealers to price-conscious direct-response firms. According to International Data Corporation (IDC), the average street price of 486-33 systems fell by 34 percent from 1991 to 1992, thanks in large part to aggressive vendors like Gateway.

Gateway's winning system—a 33-MHz 486 with 4MB of RAM, a 200MB hard disk, and a passel of bundled software—cost just $2295 at press time. Contrast that with $13,999 for last year's winner, the Deskpro 486/33L, and it's clear why Gateway has won the allegiance of our readers. It also explains why Compaq has been forced to regroup with a new line of low-cost PCs—such as its current 486/33M, which sells for $3069, as well as its ProLinea and Deskpro/i PCs (see "Compaq Gets Budget Minded," August 1992).

But price is only part of the story. Gateway's success is also due to its ability to provide the custom configuration and support large corporations crave. Recent surveys by Computer Intelligence (CI) in La Jolla, California, show Gateway PCs rank fifth among those purchased by companies with more than 500 employees. (Dell ranks third, just behind Compaq and IBM and ahead of Apple.)

"Corporations look at PCs as a cost item that needs to be managed," says CI senior analyst Dan Ness. "It may seem trivial to install software and upgrade the RAM in a system, but multiply that by 300 and it becomes expensive." Firms like Dell and Gateway can configure each system before shipping it—saving companies thousands of dollars in support costs.

Gateway's victory is also evidence of an increasingly sophisticated user base. "What we're seeing is a comfort level with *technology* that makes it unnecessary for customers to have a comfort level with a brand name," says Amy Wohl, editor of *TrendsLetter* in Bala Cynwyd, Pennsylvania.

But sometimes it's the intangibles like image and public perception that help turn the tide against bigger competitors. While Dell continued to batter Compaq with an aggressively targeted ad campaign, Gateway won the affection of *PC World* readers with its down-home image and bovinely inspired marketing.

"Gateway has such personality," says Portia Isaacson, principal analyst with The Dream IT, a market research firm in Colorado Springs. "Being a farm girl from Oklahoma, I would buy any computer that comes in a cow box. Dell is efficient, but it's not as cuddly as Gateway."

But Gateway may find its victory hard to repeat as Compaq and other big vendors enter the price wars. "If prices go down much further," warns Wohl, "we'll hit the bottom of the curve, and some companies will fall out of the market. I think in '93 the focus will be on adding features rather than continuing price compression."

Transportables: 486 Dream Machines

Any politician will tell you that you can't win without a good platform, and as the World Class numbers show, our readers' platform of choice is now the 486. This year 53 percent of our voters opted for 486 desktops—up from 29 percent last year—putting our readers a solid two years ahead of the market. IDC projects that

The Forecast for 1993

We asked our panel of experts to gaze into their crystal balls and tell us what they see for 1993. Here's what they said.

Bill Higgs, InfoCorp
"The big thing in 1993 will be the likely entry of *Quattro Pro for Windows*. That will make it a three-horse race instead of a two-horse race. But Borland is used to focusing their marketing efforts against Lotus. How do they get share of mind against *Excel*?"

Portia Isaacson, The Dream IT
"386 notebooks will all but disappear in 1993. It's amazing how fast this happened—thank you, Bill Gates. *Windows* on a 386 machine is depressing."

Jesse Berst, *Windows Watcher*
"*Windows for Workgroups* is going to have a big impact. By mid-1993 I expect it will account for 30 percent of all *Windows* sales, counting all flavors. By year-end, 40 percent or even higher.

"It opens up a whole new market: small and medium-size businesses that aren't yet networked; and people in large corporations who need to connect in small groups, but whose connect needs aren't big enough to justify the pain of connecting to the enterprisewide LAN."

Amy Wohl, TrendsLetter
"People are moving up to higher-level platforms. The 586 [P5] will enter the market next year, there will be more RISC-based computers, and even more laptops."

Jeffrey Tarter, Soft-letter
"The biggest trend in the classic categories of word processing and spreadsheets is no trend at all. The majority of people will continue to do exactly what they have been doing with versions of products they've always used."

Rikki Kirzner, Dataquest
"Windows NT will walk away with the market, but the big impact will come when NT is fully integrated with networking capabilities, which won't happen before early '94. Microsoft needs some time to shake all the bugs out of it."

486s will grow from 15 percent of all U.S. PC shipments in 1992 to 47 percent by 1994.

This trend is even more pronounced in the race for top portable and notebook computers. For the first time in World Class history, 486-based PCs won both categories: Toshiba's T4400SXC captured the notebook crown and lost by a hair to Compaq's 486c for top portable. Here, voters opted for technology over price—both machines feature gorgeous but costly active-matrix color screens.

With its 25-MHz 486SX and state-of-the-art color LCD, Toshiba's 7½-pound T4400SXC has brains as well as looks. A model with 4MB RAM and an 80MB drive lists for $5499—about $2000 more than its black-and-white cousins. Compaq's solid 17.6-pound lunch box features a 33-MHz 486 and a 256-color screen that easily surpasses most desktop displays. A built-in audio jack and SCSI port for a CD ROM drive show the $8699 Portable 486c was designed with multimedia in mind.

By choosing dream machines like these, *PC World*'s readers are telling us they're no longer willing to trade power for portability. Many users who split their time between the office and the road will look to replace older desktop systems with more powerful traveling machines. "If you need to upgrade to a higher platform, and you have to be away from your desk once in a while, most organizations would rather give you one portable machine that's good enough to use all the time," notes Wohl.

The most dramatic changes came in desktop computers and transportables, as voters gave a strong thumbs-up to low-cost 486s and threw their support behind the most colorful candidates.

But with active-matrix screens in limited supply, don't expect 1993 sales of high-end color transportables to shoot through the roof—or prices to drop through the floor. The real action next year will be with monochrome notebooks and cheaper passive-matrix color models, thanks to the expected appearance of Intel's low-power 486SL chip (see our test drive of Compaq's 486SL-based notebook in *Top of the News*). "If you think the shift to the 486 is rapid on the desktop," says Isaacson, "the 486SL notebooks will blow the market away."

Class of '89: Most Likely to Succeed

Sometimes people need a push to realize their dreams. Three years ago, Vic Cherubini got that push when he won the grand prize in *PC World*'s seventh annual World Class Awards. Suddenly, Cherubini was the proud owner of a Compaq Deskpro 386/25, plus all the other hardware and software that had topped our readers' lists.

Vic Cherubini, winner of the 1989 World Class Awards, with some of the prizes that helped launch his company.

"It was hard to believe at first," he says now, "but as the prizes began trickling in, I knew I wasn't dreaming. By the middle of fall, I had a room full of software and hardware." As an MBA and national sales manager for Canusa Ltd., a Texas pipeline coating firm, Cherubini had a solid job with a promising future, but he also had a dream: to start his own software company. "I knew exactly what I wanted to do, yet the thought of leaving a secure nine-to-five job for the unknown world of software development scared me," he explains. "But winning those prizes convinced me that if I didn't take the chance now, I never would."

So he did. In May 1990 he started E.P.I.C. Software Group, an advertising agency specializing in interactive floppy disk–based presentations for sales and marketing people to use in place of printed sales literature. Based in The Woodlands, Texas, the E.P.I.C. crew creates presentations that integrate sound, animation, high-resolution graphics, and expert systems to create electronic catalogs, demo programs, and ads.

The first year, he says, was difficult, but "the business is stable now, the future of the computer as a communications medium is all but guaranteed, and we're having a good time. I realize it was just the luck of the draw," he adds, "but winning that contest changed my life. If you look around our office today, you still see the remains of many of the prizes. It was the 'seed capital' we needed to get the company going."

—Steve Fox

Software

Windows is like the weather: Everybody talks about it, but only God and Microsoft can do anything about it. The influence of Bill Gates's favorite environment was felt everywhere, from the burgeoning demand for 486 systems to the shift away from established DOS applications.

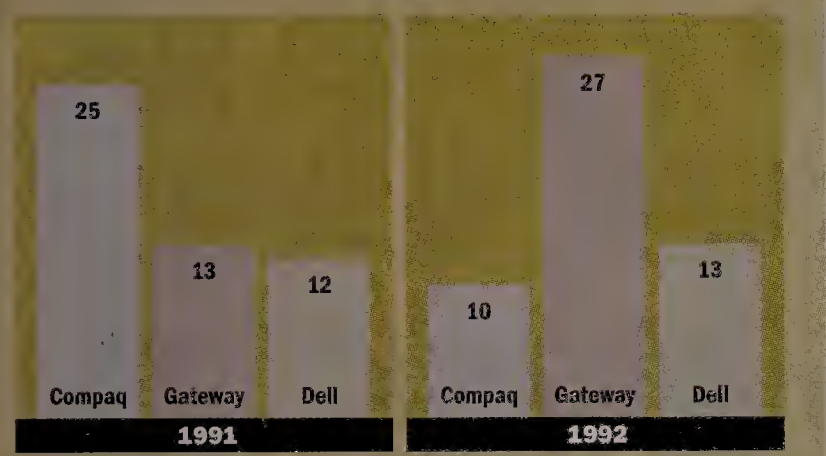
This year's World Class Awards saw the emergence of a movement to toss out the DOS incumbents in favor of graphical candidates. The number of *Windows* applications listed in the top five for each category rose from 13 percent in 1991 to almost 35 percent, as *Windows* versions of old DOS favorites made their debuts. This year's vote shows dramatic shifts in word processors and spreadsheets—as well as surprising developments in operating systems and LAN software. While users are moving toward graphical interfaces, it seems *PC World* readers are moving there even faster.

Word Processors: Less Perfect

Since 1986 *WordPerfect* has been the FDR of the word processing category, winning

Meet the New Boss

Percentage of total World Class votes cast for best desktop computer



When it comes to desktop computers, PC World readers can be a fickle bunch. While Dell kept a steady hold on its constituency in 1992, voters moved in droves from Compaq to Gateway.

year after year with larger and larger margins. But this year the DOS word processing giant found itself neck and neck with *Microsoft Word for Windows*, winning by a single percentage point. That's far from the 55 to 22 shellacking *WordPerfect* posted just one year ago.

Word for Windows may have captured the hearts and minds of many *PC World* readers, but *WordPerfect* still commands their wallets. According to IDC, the DOS word processor captured more than 46 percent of U.S. unit sales in 1991, compared with 18 percent for *WinWord*.

The writing, however, is on the wall. In 1991, *Windows* word processors garnered about 20 percent of the World Class vote. In 1992 this figure ballooned to more than 50 percent, spurred by the release of *WinWord 2.0* and the long-awaited arrival of *WordPerfect for Windows*. This trend mirrors the industry at large, where *Windows* word processors grew from 9 percent of all shipments in 1990 to 33 percent in 1991. While no one expects DOS word processors to fade away, the era of their domination has begun to pass.

"Five years from now—maybe even three—I expect *Windows* word processors to be more than half of all word processors installed," says Bill Higgs, vice president of software research for InfoCorp in Santa Clara, California.

While *WinWord* has the early lead in the *Windows* word processor market, most analysts expect *WordPerfect for Windows* to come on strong, as corporations already standardized on the DOS version move to *Windows*. "It will take dynamite to get them off that track," says Wohl.

Anticipated upgrades to the DOS versions of both *WordPerfect* and *Word*, as well as to Lotus's well-received *Ami Pro 3.0*, should make next year's word processing contest even tighter.

Spreadsheets: Search for Excel-lence

Last year Borland's *Quattro Pro* pulled an October surprise, wresting the spreadsheet title from Lotus's *1-2-3* for the first time in World Class history. This year it was *Microsoft Excel*'s chance to turn the spreadsheet tables. Buoyed by the release of version 4.0, the *Windows* spreadsheet easily defeated the DOS-based *Quattro* and outpointed all versions of *1-2-3* combined.

"*Excel 4.0* is the best spreadsheet anywhere on any platform," says Jesse Berst, editor and publisher of *Windows Watcher* in Redmond, Washington. "It combines technical strength with a great head start against no competition—for a while *Excel* was the only *Windows* spreadsheet around."

Again, the shift in loyalty from DOS to *Windows* is clear. Last year graphical spreadsheets drew about 25 percent of the vote, this year more than twice that number went graphical, thanks to *Excel*'s strong performance and the appearance of *1-2-3 for Windows*. Likewise, worldwide shipments of *Windows*-based spreadsheets grew from 12 percent in 1990 to 31 percent for the first half of 1991.

But *1-2-3 for Windows*' capability to hold on to Lotus's huge installed base of DOS users is far from assured—especially now that *Quattro Pro for Windows* has entered the market.

"Users moving to *Windows* are in for a certain amount of interface shock," notes IDC's Mary Conti-Loffredo. "All the programs look alike. When products lose their old-time individuality, users have to start from scratch. It wouldn't surprise me at all if next year's *Windows* market shares were *Excel* 30 percent, *1-2-3* 30 percent, and *Quattro Pro* 30 percent."

Operating Systems: The Comeback Kid

With the release of version 3.1, *Windows* expanded its World Class share from 36 percent in 1991 to 42 percent this year, fending off a hard-charging DOS 5.0. But the real story in 1992 was OS/2. Version 2.0 of IBM's multitasking operating system emerged from the ashes to place a strong third in the running and, in an ironic twist, to snag the title of software's most promising newcomer.

Will OS/2 overtake *Windows* in next year's World Class contest? Can you say "President Jerry Brown"? While IBM is on track to ship 1 million copies of OS/2 by the end of the year, that's still

Management Software: Tomorrow's Killer Apps?

Earlier in the year, we had a heated discussion here at *PC World*. Our readers, the argument went, are big-time PC users, many of them managers. So what software tools are they using to manage? We couldn't agree, so we turned to you, asking you to name your favorite "management tool." Apparently you couldn't agree either, since the answers ranged from traditional project management software to spreadsheets, utility libraries, and operating environments. Some of our more creative participants offered up responses like "eye contact," "a good secretary," and "a Colt 45 automatic."

There's a message here to the software industry: If you can develop the right tools, there's an untapped market of managers who need your help. Who knows? Management tools may be the so-called killer apps we've all been waiting for. In the meantime, we applaud the handful of savvy readers who came up with the answer "PC World." Thanks for the vote of confidence.

dwarfed by *Windows'* current base of some 15 million users. OS/2's real competition is Windows NT, the much-anticipated operating system that promises true *Windows* multitasking without the underlying DOS layer. "Microsoft must get NT out the door within a reasonable time frame," cautions Berst. "Every month it continues to be vaporware gives OS/2 time to build momentum."

Dataquest's Rikki Kirzner predicts that OS/2 will be found on only 5 to 7 percent of desktops by 1996, almost all in true-Blue shops. "I don't see OS/2 competing successfully outside IBM's own market," says Kirzner, senior industry analyst for the San Jose, California, research firm. "Between DOS, *Windows*, and Windows NT, Microsoft will control 80 percent of the PC market."

The real story in 1992 was OS/2. Version 2.0 emerged from the ashes to place a strong third in the running and, in an ironic twist, to snag the title of software's most promising newcomer.

LAN OS: Small Is Beautiful

It's like clockwork: Every year since 1988 at least one major publication has proclaimed it the year of the LAN, and Novell NetWare has won the World Class award for top network operating system. But this year the clock stopped, as Artisoft's *Lantastic* surged past NetWare to capture the network crown.

Unlike NetWare 2.*x* and 3.*x*, *Lantastic* is a peer-to-peer system that doesn't typically require a dedicated PC as file server. Its low cost and flexibility can make it a better choice for users who want to share applications and resources between a handful of PCs.

Lantastic's victory signals a change in reader perception of networks as expensive installations strictly for big organizations. "A couple of years ago, networking was a niche market," notes Patrick Corrigan, managing director of the Corrigan Group in Sausalito, California. "Now it's mainstream. There's a lot more being done at the low end with small LANs."

Partial credit for Artisoft's success must go to Novell, which introduced its own peer-to-peer LAN earlier this year. "Novell's getting in the market with NetWare Lite is the best thing that's happened to Artisoft," says Jamie Lewis, vice president of information services for The Burton Group in Salt Lake City. "It lent peer-to-peer networks legitimacy, and *Lantastic* is better than NetWare Lite."

This year's World Class vote provides further evidence of readers' growing interest in network solutions. Last year, only 20 percent of respondents voted for their favorite network operating system; this year that figure nearly doubled. IDC reports that a third of all business PCs are now networked, and the number will grow to more than 50 percent by 1996.

You, the People

As World Class enters its second decade, it's clear that the only constant in this industry is change. There will always be new products, new technologies, and new readers willing to make their opinions known. Here, as elsewhere, your vote can make a difference. Exercise your fundamental rights in 1993—and come join the party.

Daniel Tynan is a contributing editor and Steve Fox is a senior editor for PC World. *They can be reached on PC World Online (see page 8 for more information).*

The 1992 World Class ballots were tabulated by Techtel Corporation, a market research firm in Emeryville, California. Additional research was provided by Thomas Gewecke, research manager for PC World.

Winning Combinations

On a Roll

Products and companies that have won World Class Awards in their categories at least three years in a row.

Product	Number of years
Microsoft Mouse	10 [1]
Hewlett-Packard LaserJet [2]	8 [1]
AutoCAD	7 [1]
TurboTax	7
WordPerfect	7
NEC MultiSync [2]	6
Harvard Graphics (DOS)	5
ATI graphics board [2]	4
Procomm Plus	4
PageMaker	3
Quicken	3
WordPerfect Corporation	3 [1, 3]
PC Connection	3 [1, 4]
Panasonic KX-P1124i	3

[1] Has won every year category has existed.
[2] Various models. [3] For service and support–software.
[4] For mail-order company.

First-Time Winners 1992

Products that won World Class Awards in their categories for the first time in 1992.

Product	Category
Gateway 2000 4D33	Desktop computer
Compaq Portable 486c	Portable computer
Toshiba T4400SXC	Notebook computer
Intel 14.4EX Modem	Modem
Seagate ST3144A	Hard disk
Bernoulli Transportable 90 Pro	Removable/portable hard disk [1]
CMS Jumbo 250	Tape backup drive
Logitech ScanMan 256	Scanner
Gateway 2000	Service and support—hardware
Microsoft Excel	Spreadsheet
Lantastic	LAN operating system
Polaris PackRat	Personal information manager
Borland C++	Programming language
Microsoft Project for Windows	Project manager, Management tool [1]

[1] New category.

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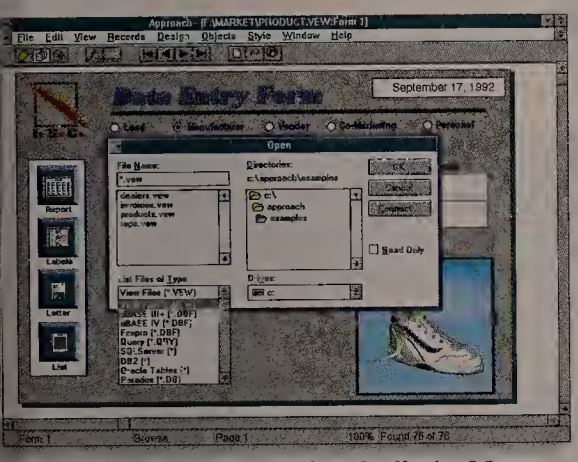

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For information, or to order, call your local dealer or **1-800-APPROACH.**

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WORLD CLASS
BEST OF '92

HARDWARE

Desktop Computer

Product, Manufacturer	% of votes
4D33, Gateway 2000	9
40X2-50, Gateway 2000	8
System 486/50, Dell Computer	4
Deskpro 486/33L, Compaq Computer ★☆	4
386/33MHz, Gateway 2000	3
Others	72

82 percent of the respondents voted in this category

Ink Jet Printer

Product, Manufacturer	% of votes
HP DeskJet 500, Hewlett-Packard ★	28
HP DeskJet 500C, Hewlett-Packard	21
HP PaintJet XL300, Hewlett-Packard	8
Canon BJ-10ex, Canon America	6
Canon BJ-330, Canon America	5
Others	32

50 percent of the respondents voted in this category

Portable Computer

Compaq Portable 486c, Compaq Computer	7*
T4400SXC, Toshiba America	7
Nomad 425DXL, Gateway 2000	4
Compaq LTE Lite/20, Compaq Computer	3
T5200C, Toshiba America ★	3
Others	76

38 percent of the respondents voted in this category

* Percentage rounded; product received largest number of votes.

Monitor

MultiSync 4FG, NEC Technologies ☆	18
MultiSync 5FG, NEC Technologies	15
MultiSync 6FG, NEC Technologies	10
MultiSync 3FGX, NEC Technologies	3
MultiSync 5D, NEC Technologies	3
Others	51

68 percent of the respondents voted in this category

Notebook Computer

T4400SXC, Toshiba America	15
Nomad 4250XL, Gateway 2000	7
Compaq LTE Lite/25, Compaq Computer	6
DECpc 320P, Digital Equipment Corp.	5
TI TravelMate 3000, Texas Instruments ★☆	4
Others	63

51 percent of the respondents voted in this category

Modem

14.4EX Modem, Intel	7
Ultra 144, Hayes Microcomputer Products	6
Ultra 96, Hayes Microcomputer Products	5
Courier V.32bis, US Robotics	4
Optima 96, Hayes Microcomputer Products	4
Others	74

55 percent of the respondents voted in this category

Laser Printer

HP LaserJet III, Hewlett-Packard ★	28
HP LaserJet IIIP, Hewlett-Packard	10
HP LaserJet IIISi, Hewlett-Packard	8
HP LaserJet IIIO, Hewlett-Packard	6
NEC Silentwriter Model 95, NEC Information Systems	5
Others	43

76 percent of the respondents voted in this category

Fax Board

SatisFaxtion Modem/200, Intel	32
SatisFaxtion Modem/400, Intel	15
SatisFaxtion Modem/400e, Intel	4
TelePath, Gateway 2000	3
Zoom FC 9624, Zoom Electronics	3
Others	43

36 percent of the respondents voted in this category

Dot Matrix Printer

Panasonic KX-P1124i, Panasonic ★	15
Panasonic KX-P2624, Panasonic	9
Epson LQ-870, Epson America	7
Epson LQ-1170, Epson America	7
Epson LQ-2550, Epson America	5
Others	57

68 percent of the respondents voted in this category

Percentages rounded to nearest whole number; winners are determined by raw vote totals.

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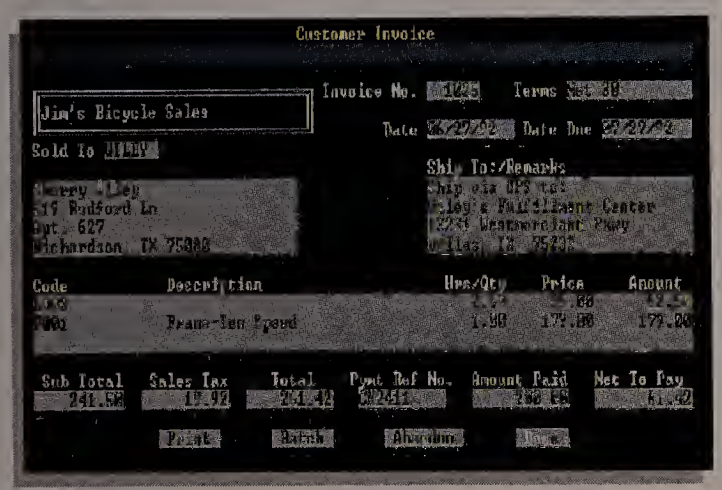
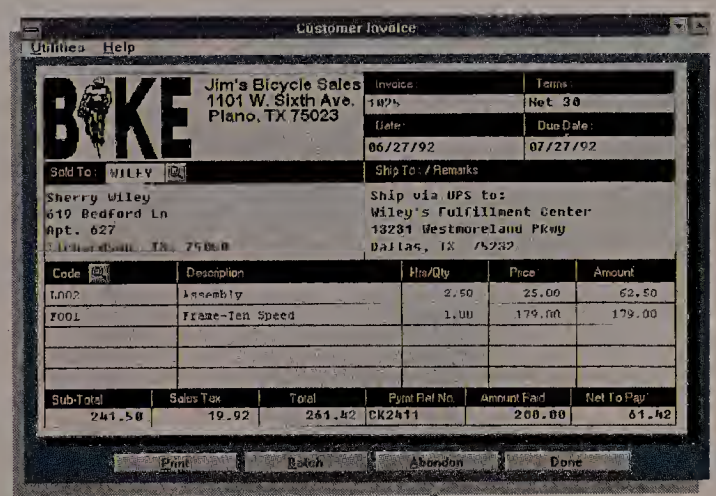


DOS Invoice Screen



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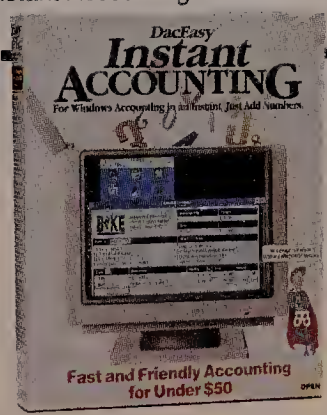

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It's not surprising WordP
Microsoft Word for Win

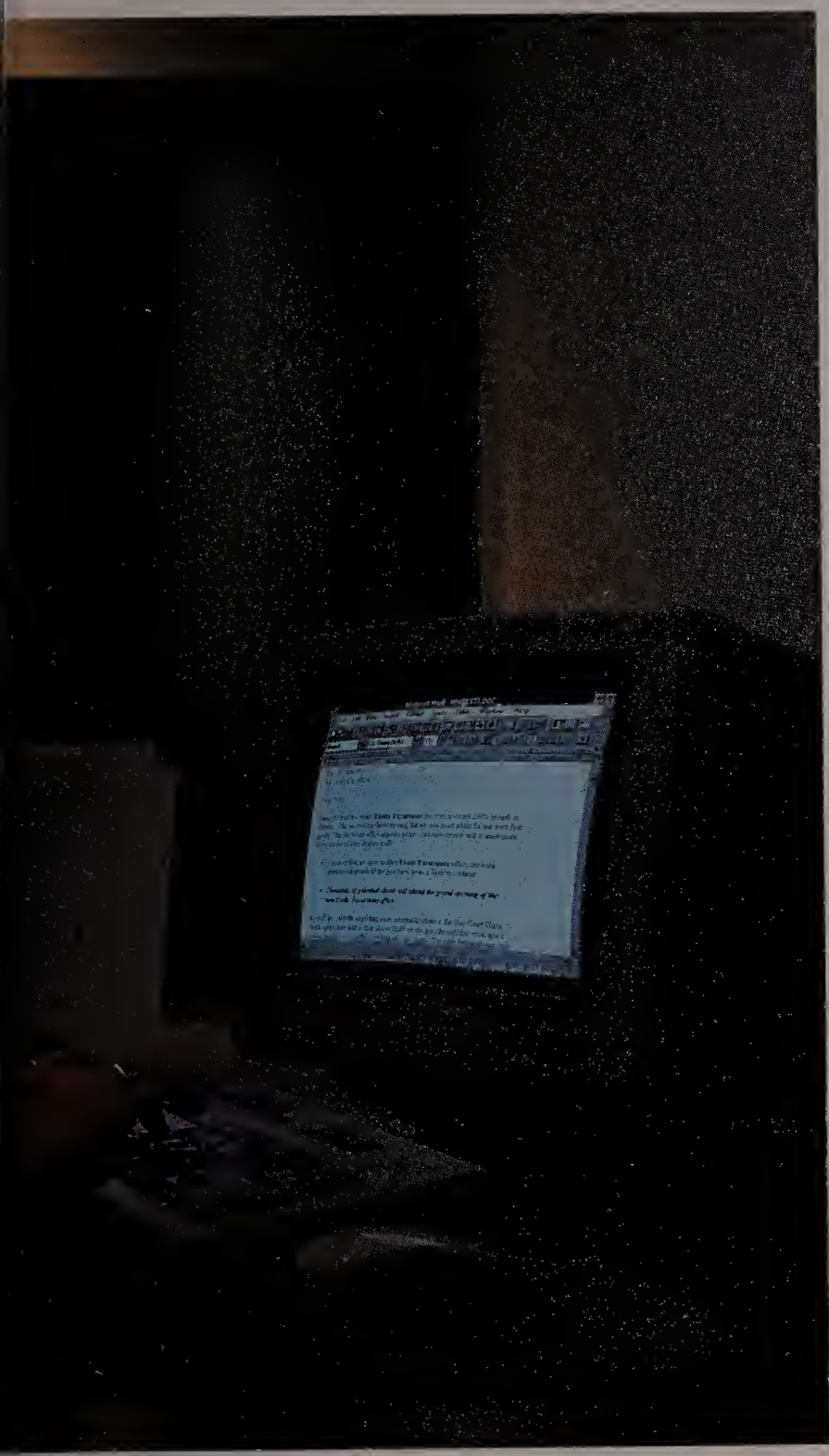
At last count, more than half a million WordPerfect® for DOS users have moved to the number one word processing software for Windows™: Microsoft® Word version 2.0 for Windows. And there are plenty of good reasons why.

First of all, WordPerfect for DOS users actually helped us to make Word for Windows easier to use.

During the development of Word for Windows, we invited WordPerfect

*Each year shows approximate total number of users who have switched. For more information inside the 50 United States, call (800) 426-9400, Dept HY9. Outside the U.S. and Canada, call (206) 936-8661. Customers in Canada,

ect users are switching to ws. They helped define it.

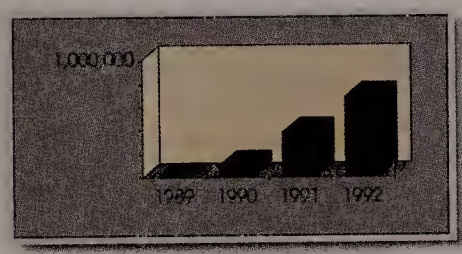


users to try it out on the things they do every day at work. We call these types of sessions "usability studies." They help us find out the way in which people use their computers, and how we can make it easier for them.

In this case, we were able to design features that can make not only your everyday work easier, but also the transition from WordPerfect.

Like the customizable Toolbar. It gives you one-step access to inserting bullets and printing envelopes. Word for Windows can also take all your familiar commands in WordPerfect, and then display the equivalent commands. So you can learn while you're working on your everyday tasks.

From November 1989 to August 1992, over half a million WordPerfect users have switched to Microsoft Word for Windows.*



We even had the National Software Testing Labs put Word for Windows to the test in ten cities across the country. The result was that nearly 8 out of 10 WordPerfect users preferred Microsoft Word for Windows for ease-of-use over WordPerfect for Windows.

But they're not the only ones who prefer Word for Windows. This year, it received numerous industry awards, including "Best Buy" by *PC World*, and "Editors' Choice" by *PC Magazine*.

To find out how easy it is to make the switch to Word for Windows, just give us a call at (800) 426-9400, Dept. HY9. And then spread the Word.

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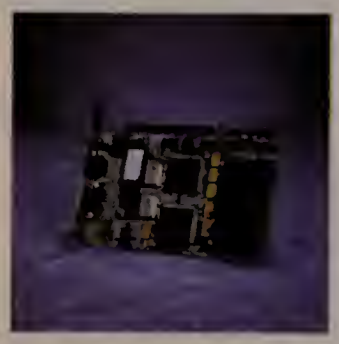
HARDWARE

Memory Expansion Board

AboveBoard 2 Plus, Intel	16
BocaRAM/AT Plus, Boca Research	14
AboveBoard Plus 8, Intel ★	9
BocaRAM/AT, Boca Research	5
Everex RAM 8000, Everex	3
Others	53

26 percent of the respondents voted in this category

Graphics Board



Graphics Ultra, ATI Technologies ☆	36
Stealth VRAM, Diamond Computer Systems	9
VGAWonder XL, ATI Technologies ☆	9
8514 Ultra, ATI Technologies	6
Fahrenheit 1280, Orchid Technology	6
Others	34

45 percent of the respondents voted in this category

Hard Drive

Seagate ST3144A, Seagate Technology	7
Conner CP-3204, Conner Peripherals	6
Seagate ST1239A, Seagate Technology	6
Quantum ProDrive LPS 120, Quantum	5
Cheyenne 7213 A/S, Maxtor	3
Others	73

50 percent of the respondents voted in this category

Removable/Portable Hard Drive

Bernoulli Transportable 90 Pro, Iomega	26
Sysgen Mobile Disk 200, Sysgen	7
SyDOS 88/2, SyQuest	6
Sysgen Mobile Disk 40, Sysgen	5
Bernoulli Dual 90 Pro, Iomega	4
Others	52

27 percent of the respondents voted in this category

Tape Backup Drive

Jumbo 250, Colorado Memory Systems	32
QFA700, Colorado Memory Systems	12
Jumbo 120, Colorado Memory Systems ★	10
Irwin AccuTrak A250, Maynard Electronics	2
Mountain FileSafe 8000Plus, Mountain Network Solutions	2
Others	42

41 percent of the respondents voted in this category

Scanner

Product, Manufacturer	% of votes
ScanMan 256, Logitech	25
HP ScanJet IIC, Hewlett-Packard	22
HP ScanJet IIP, Hewlett-Packard	17
Microtek 600, Microtek	6
Umax 1200, Umax Technologies	4
Others	26

45 percent of the respondents voted in this category

Pointing Device

Microsoft Mouse, Microsoft ★	48
MouseMan, Logitech	17
TrackMan, Logitech	10
MouseMan Cordless, Logitech	5
Microsoft Ballpoint Mouse, Microsoft	2
Others	18

60 percent of the respondents voted in this category

Most Promising Newcomer

FotoMan, Logitech	4
Nomad 425DXL, Gateway 2000	3
T4400SXC, Toshiba America	2
Intel 486DX2, Intel	2
Cyrix 486SLC, Cyrix	2
Others	87

33 percent of the respondents voted in this category.

Best Service and Support

Hardware

Gateway 2000	22
Dell Computer ★	14
Zeos	8
IBM	6
Hewlett-Packard	6
Others	44

51 percent of the respondents voted in this category

Software

WordPerfect ★	28
Microsoft	19
Borland	10
Lotus	6
Symantec	4
Others	33

49 percent of the respondents voted in this category

Percentages rounded to nearest whole number; winners are determined by raw vote totals.

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SOFTWARE

Word Processing

Product, Manufacturer	% of votes
WordPerfect (DDS), WordPerfect ★	33
Microsoft Word for Windows, Microsoft ☆	32
Ami Pro, Lotus Development ☆	12
WordPerfect for Windows, WordPerfect	9
Microsoft Word (DDS), Microsoft ☆	5
Others	9

91 percent of the respondents voted in this category

Communications

Product, Manufacturer	% of votes
ProComm Plus, DataStorm Technologies ★☆	46
ProComm Plus for Windows, DataStorm Technologies	9
Crosstalk for Windows, DCA	6
Crosstalk Communicator, DCA ☆	4
Telix, Exis	3
Others	32

56 percent of the respondents voted in this category

Spreadsheet

Microsoft Excel, Microsoft ☆	42
Quattro Pro, Borland Int'l ★	27
1-2-3 2.xx, Lotus Development	14
1-2-3 for Windows, Lotus Development	8
1-2-3 3.xx, Lotus Development	7
Others	2

82 percent of the respondents voted in this category

Backup Software

Central Point Backup, Central Point Software ★☆	45
Norton Backup, Symantec ☆	20
Fastback Plus, Fifth Generation Systems	17
Norton Backup for Windows, Symantec	5
Fastback Plus for Windows, Fifth Generation Systems	1
Others	12

55 percent of the respondents voted in this category

Operating System/Environment

Microsoft Windows 3.xx, Microsoft ★	43
MS-DOS 5.0, Microsoft	32
OS/2 2.xx, IBM	11
DR DOS, Digital Research	7
MS-DOS/PC-DOS 3.xx, Microsoft/IBM	3
Others	4

79 percent of the respondents voted in this category

Desktop Publishing

PageMaker, Aldus ★	47
Microsoft Publisher, Microsoft	11
Ventura Publisher for Windows, Ventura Software	8
Ventura Publisher DOS/GEM, Ventura Software	6
Express Publisher, Power Up Software	4
Others	24

53 percent of the respondents voted in this category

Utility

Norton Utilities, Symantec ☆	34
PC Tools, Central Point Software ★	29
Norton Desktop for Windows, Symantec	8
XTree Gold, Executive Systems	5
Stacker, Stac Electronics	3
Others	21

68 percent of the respondents voted in this category

Draw Software

CorelDraw, Corel Systems ★☆	48
Micrografx Designer, Micrografx	8
Micrografx Windows Draw, Micrografx	7
Adobe Illustrator, Adobe Systems	6
DrawPerfect, WordPerfect	4
Others	27

50 percent of the respondents voted in this category

Database

Paradox, Borland Int'l ★,☆	27
dBASE IV, Borland Int'l	20
FoxPro, Microsoft	19
Alpha Four, Alpha Software	8
Q&A, Symantec ★	6
Others	20

57 percent of the respondents voted in this category

Personal Finance

Quicken (DDS), Intuit ★	44
Quicken for Windows, Intuit	18
Andrew Tobias' Managing Your Money, MECA Software ☆	14
Microsoft Money, Microsoft	8
MoneyCounts, Parsons Technology	4
Others	12

50 percent of the respondents voted in this category

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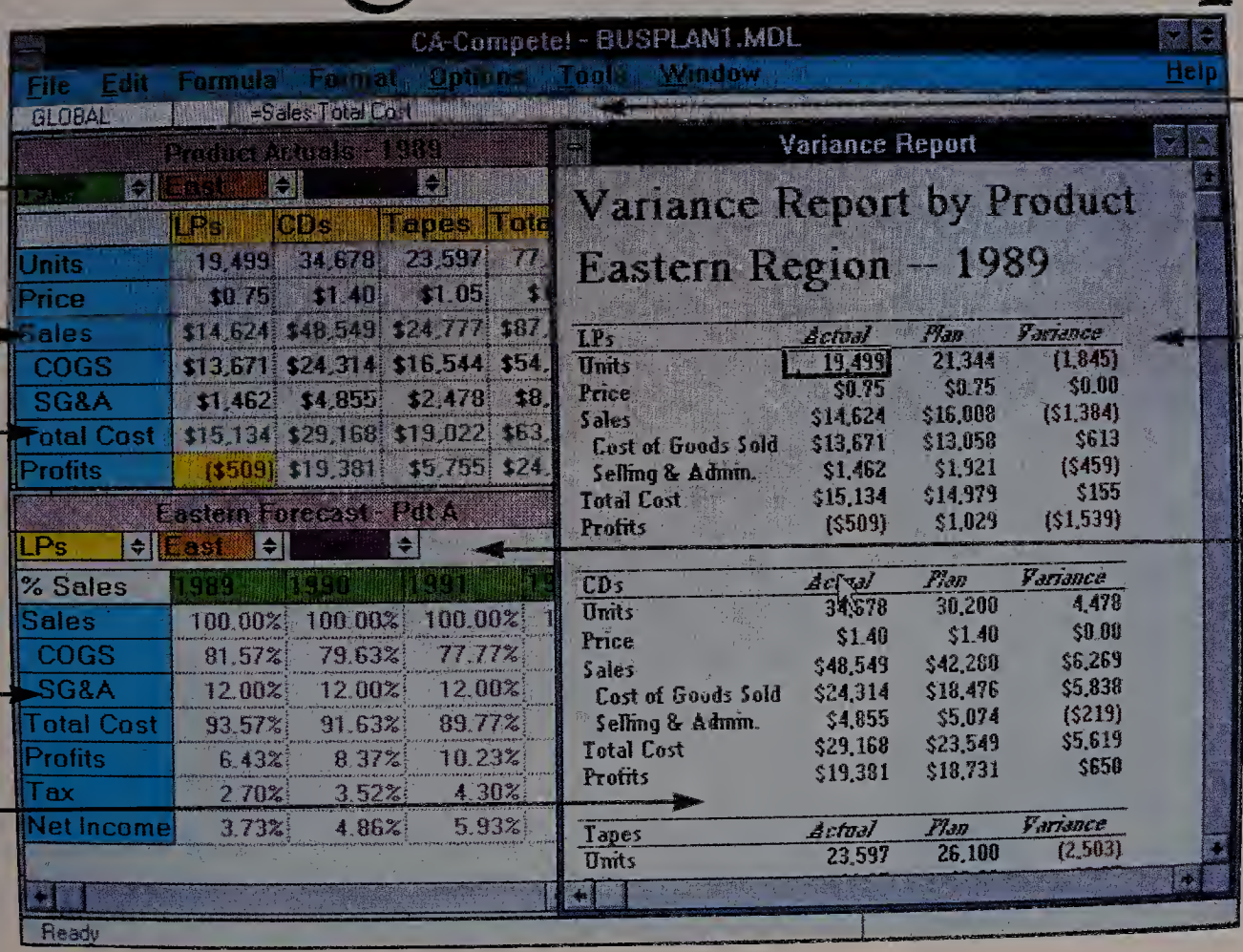

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Welcome to the world of multi-dimensional modeling & viewing.

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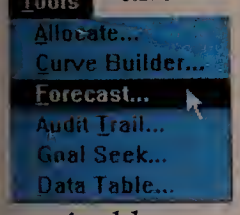

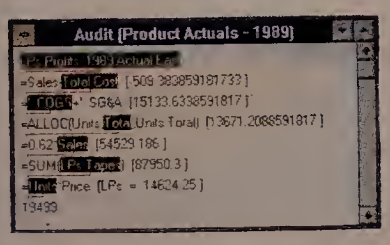

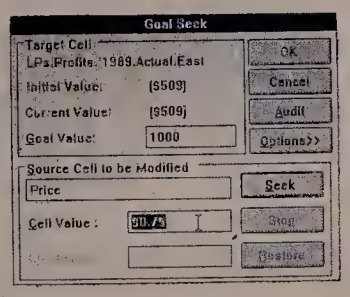

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Circle 58 on reader service card

The only notebook with a tilt & swivel display. Great for sharing data or keeping it private. Easily adjusts for perfect viewing.

This fine Italian leather carrying case is an additional option. Loaded with pockets and features everyone will appreciate.

Digital brightness and contrast buttons make screen adjustment so easy.

ZEOS® Freestyle/SL. More features at a lower cost than any other notebook.

Period.

To try and compare the new ZEOS Freestyle/SL to any other notebook is next to impossible. Because nothing else has all its features. And even with all these great features, nobody can match the price. Features and price. It would seem the new ZEOS Freestyle/SL is the best of all worlds. It is.

DESIGNED BY USERS. JUST LIKE YOU!

We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power *and* great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

SL POWER. SL BATTERY LIFE. 64K CACHE!

2MB, 60MB Only $1895!

We listened well.

Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.

And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be quick-charged when the system is not being used or trickle-charged when in use. So what happens when the power is on?

GREAT VIDEO TOO.

You get great video! Because for video control, we chose the amazing new Cirrus Logic VGA controller. It not only consumes less power, it also produces the fast crisp images you're looking for. And with a business machine like this you'll also appreciate our dual display capabilities. You can connect an external VGA color monitor for simultaneous co-display. And that's not all.

A NOTEBOOK KEYBOARD YOU'RE GOING TO LOVE.

We re-designed and re-sculpted every key from scratch. Even the key-switch mechanism was invented anew. And we added the mouse key for easy cursor control. It is the absolute perfect notebook keyboard. What else?

Lots else! Like the best display system of any notebook available anywhere. We listened here too. The screen is big and easy to read. Plus, it's high contrast and it's fast. It's also very easy to adjust. People said contrast and brightness knobs were hard to use. So we replaced them with soft touch buttons that *electronically* adjust screen settings at your command. Then we really got creative.

THE ONLY NOTEBOOK WITH A TILT & SWIVEL DISPLAY.

Can you imagine your desktop PC without a tilt and swivel display? Neither could we. So why not incorporate that feature into a notebook. With the ZEOS Freestyle/SL notebook you can adjust the screen left and right as well as tilt it up and down. Now you can truly adjust your notebook screen to the perfect viewing angle.

IT FLOATS TOO.

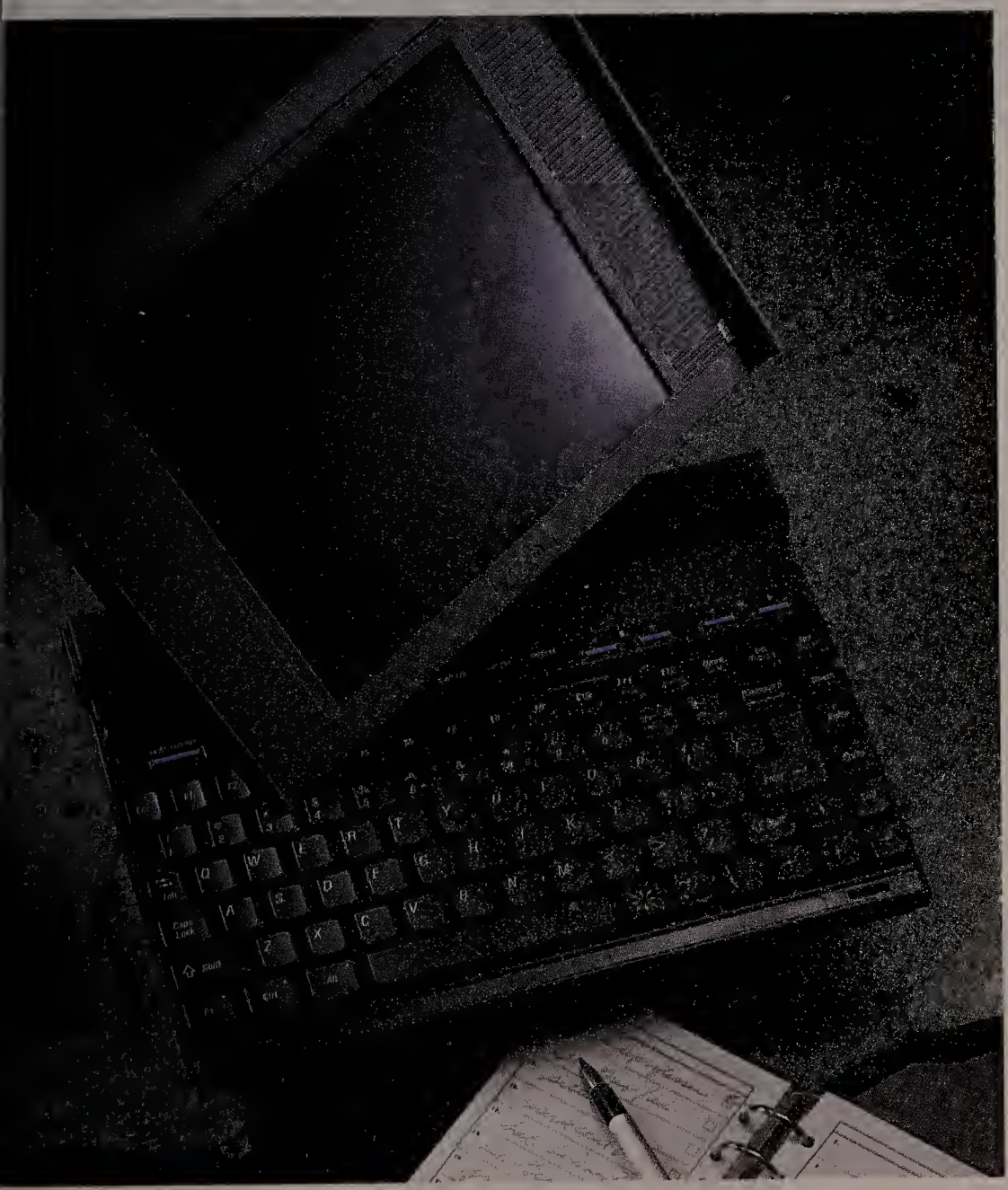
And then there is the "floating" screen. When you're facing your new ZEOS Freestyle/SL, the screen actually appears to "float" in the air in front of you. It's the only notebook that can really be used sitting on your lap!

EXTRA, EXTRA, EXTRAS. READ ALL ABOUT 'EM!

We've made more options available than ever before. Like our modem with send/receive fax. And memory up to 20MB, hard drives to 180MB, even an optional Italian leather carrying case! Extra batteries and a charging stand are available too. Call 800-423-5891 for all the details.

Built-in mouse key provides easy cursor control. Leave those bulky mice behind!

This sliding port door won't break off or come loose. Saves your fingers too.



ZEOS. #1 RATED NOTEBOOKS, SERVICE & SUPPORT!

PC Magazine recently surveyed notebook users for their Service and Reliability issue. Their findings? "Only ZEOS portable PCs achieved significantly higher-than-average ratings in all four categories." The categories were reliability, future purchase plans, repair service satisfaction and technical support. And remember, ZEOS technical support is 24 hours a day, 365 days a year, toll free. And we back your new ZEOS Freestyle with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

ORDER YOUR AMAZING ZEOS FREESTYLE/SL NOW.

Ordering your new ZEOS notebook is easy. Simply pick up the phone and give us a call. A friendly ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS notebook. Give us a call!

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- 2MB RAM standard, expandable to 20MB.
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- Quick-charge in little over an hour with the small lightweight AC adaptor.
- 8.5" x 11.3", 5.6 pounds, built-in soft carrying handle.
- 81-key keyboard with built-in full-size inverted "T" arrow keys.
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- 30-Day Money-Back Guarantee One Year Limited Warranty, ZEOS Customer Satisfaction Package.
- Loads of options. Modems, carrying cases and more!
- Designed and built by ZEOS right here in the USA.
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- Upgrade Packages Too: Call for details about absolutely loaded systems featuring more memory, bigger drives and Windows.

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SOFTWARE

Presentation Graphics

Product, Manufacturer	% of votes
Harvard Graphics (DOS), Software Publishing ★	33
Harvard Graphics for Windows, Software Publishing	10
Freelance Graphics for Windows, Lotus Development	10
Freelance Graphics (DOS), Lotus Development	10
Microsoft PowerPoint, Microsoft	9
Others	28

45 percent of the respondents voted in this category

Computer-Aided Design

AutoCAD, Autodesk ★	35
Generic CADD, Autodesk	22
DesignCAD, American Small Business Computers	16
AutoSketch, Autodesk	5
EasyCAD, Evolution Computing	2
Others	20

33 percent of the respondents voted in this category

Programming Language

Borland C++, Borland Int'l	29
Microsoft Visual Basic, Microsoft	14
Turbo Pascal, Borland Int'l	9
Turbo C++, Borland Int'l ★	7
Microsoft QuickBasic, Microsoft	6
Others	35

42 percent of the respondents voted in this category

Paint Software

PC Paintbrush, ZSoft	19
Microsoft Paintbrush, Microsoft	8
Publisher's Paintbrush for Windows, Z-Soft	8
Fractal Design Painter, Fractal Design	6
Dr. Halo, Media Cybernetics	6
Others	53

33 percent of the respondents voted in this category

LAN Operating System

Lantastic, Artisoft ☆	30
NetWare 3.xx, Novell ★,☆	25
NetWare 2.xx, Novell	21
NetWare Lite, Novell	6
Microsoft LAN Manager, Microsoft	3
Others	15

39 percent of the respondents voted in this category

Personal Information Manager

PackRat, Polaris Software	19
Agenda, Lotus Development ★	11
SideKick Plus, Borland Int'l	6
Act, Contact Software Int'l	5
InfoSelect, MicroLogic	5
Others	54

32 percent of the respondents voted in this category

Tax Planning/Preparation

TurboTax (DOS), ChipSoft ★	48
TurboTax for Windows, ChipSoft	13
Andrew Tobias' TaxCut, MECA Software	12
Personal Tax Edge, Parsons Technology	6
Quicken, Intuit	4
Others	17

39 percent of the respondents voted in this category

Forms Software

FormTool Gold, BLDC Publishing	38
PerForm Pro, Delrina Technology ☆	26
PerForm, Delrina Technology	9
FormWorx, Power Up Software	6
FormFiller, Bloc Publishing	4
Others	17

35 percent of the respondents voted in this category

Best Mail-Order Company

PC Connection ★	20
Gateway 2000	17
Dell Computer	7
Tiger Software	6
Micro Warehouse	5
Others	45

50 percent of the respondents voted in this category

Percentages rounded to nearest whole number; winners are determined by raw vote totals.

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INTRODUCING A 1.3 LB. PC. SEND & RECEIVE E-MAIL AND MORE.

Imagine a portable PC that lets you send and receive e-mail, modem a memo to the home office, write reports, create spreadsheets, manage your calendar, calculate your expenses...*work non-stop for ten hours*...and is so portable that it weighs about the same as a notepad.

A futuristic fantasy? Not unless the future is now. It's the ZEOS® Pocket PC, and only ZEOS has it. You're going to love how portable and affordable it is. In fact, we think you'll find it's the one PC you'll want to take with you everywhere!

COMPACT YET COMPLETE.

At only 9⅝" x 4½" and only 1.3 lbs., what's great about the ZEOS Pocket PC is that it has a keyboard you can really use. If you're accustomed to typing with both hands, switching to a palmtop can be awkward because the keyboard only lets you type with one hand or even one finger. Yet the ZEOS Pocket PC's keyboard lets you use both hands easily, so you won't sacrifice comfort and speed for portability.

And even though it's small, the ZEOS Pocket PC carries a *full suite of industry standard software* already loaded and ready to go! You get Microsoft DOS 5.0 system files with built-in file transfer and Microsoft Works 2.0 with word processing, spreadsheet, database and communications programs. Plus, you get a personal organizer which includes a calendar/planner, "to do" list, business card file, information retrieval (for country codes, converting measurements and currency) and more. It's everything you need to manage your life!

YOUR LINK TO THE WORLD.

Modem a memo to a client; send and retrieve your e-mail. With the Pocket PC's optional fax/modem, you can communicate worldwide. Plus, expanding the memory is another easy option—with an additional memory card that slips right into a slot on the system's underside. And that's not all.

IT JUST KEEPS GOING . . .

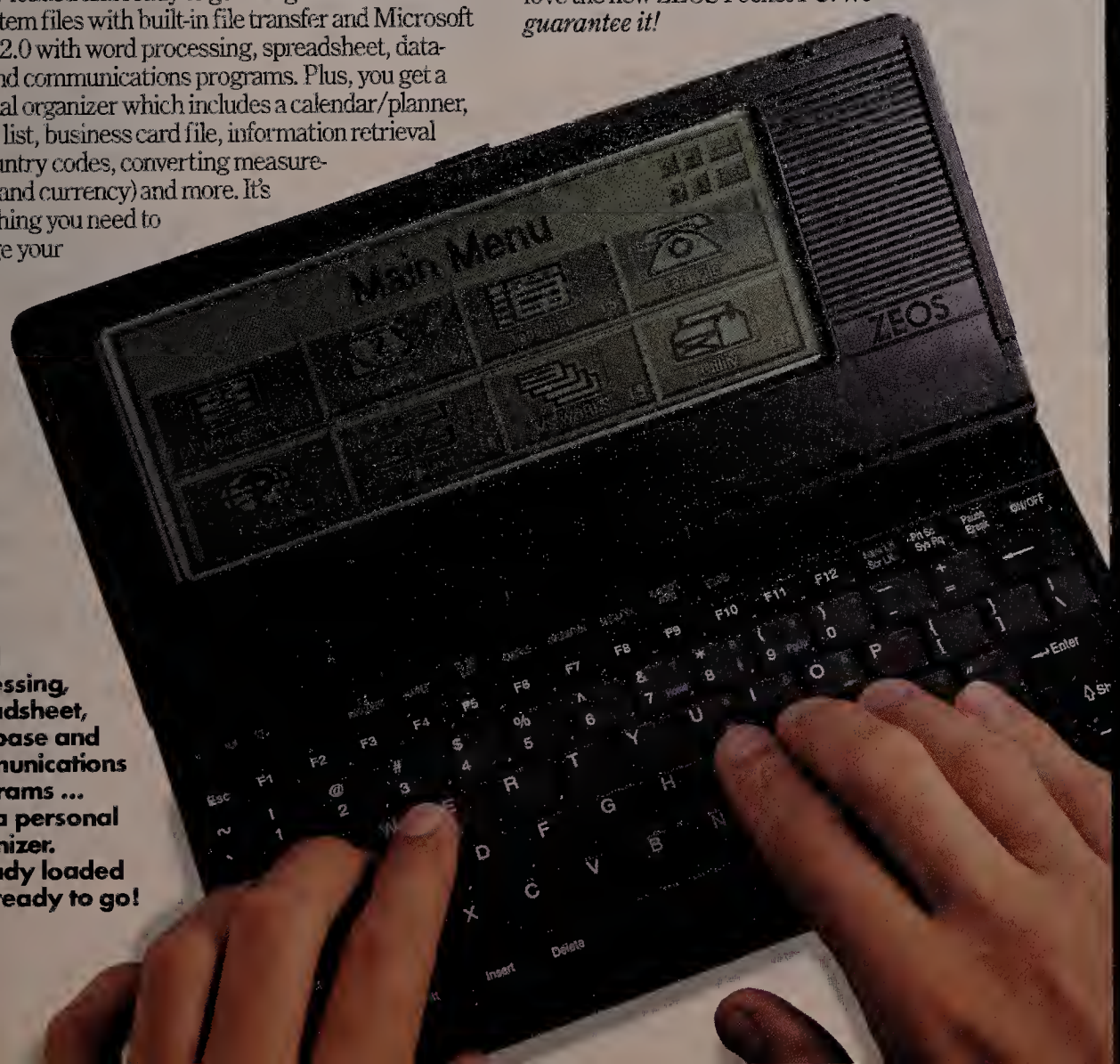
Ten hours of continuous use? Absolutely! All it takes is the two AA alkaline batteries included with your system. And your ZEOS Pocket PC has great power management, too—it automatically switches to the suspend mode when you take a break. Plus, when you turn off your system, then turn it on again, it goes right back to where you left off. What a time-saver!

FREE 24-HOUR TECH SUPPORT.

Questions about your purchase? ZEOS technical support is 24 hours a day, 365 days a year, and always toll-free. And we back every ZEOS purchase with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

ORDER YOUR ZEOS POCKET PC TODAY!

Call us today at 800-423-5891. You're going to love the new ZEOS Pocket PC. *We guarantee it!*



Word processing, spreadsheet, database and communications programs ... plus a personal organizer. Already loaded and ready to go!

"A wonder of small-scale engineering"
–*PC Week*
September 14, 1992

ONLY $595!

- ***CPU:*** Industry-standard NEC V30.
- ***Memory:*** 1 MB of RAM and 1.5 MB of ROM.
- ***Size:*** Only 1.3 lbs., 9⅝" x 4½" x ⅞".
- ***Power Supply:*** Two AA alkaline batteries and 2032 Lithium back-up battery, all included. Ten hours battery life with continuous use, even more in suspend mode!
- ***Preloaded Software:*** MS-DOS 5.0 system files, Microsoft Works 2.0 (word processing, spreadsheet, database and communications programs) and a personal organizer, planner, to do list, card file, information retrieval and calculator.
- ***I/O Ports:*** One serial, one parallel and two PCMCIA memory card connectors.
- Carrying case, cables and adapters included.
- ***Power Management:*** Automatic transition between active, doze and suspend modes.
- ***Screen:*** Easy-to-read 7" x 2¾", 640 x 200. 80 x 25 character display.
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- ***Order a Special Travel Kit for only $249! Comes with send/receive fax/modem and communications software.***

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Circle 219 on reader service card

SOFTWARE

Project Manager

Product, Manufacturer	% of votes
Microsoft Project for Windows, Microsoft	30
Microsoft Project (DOS), Microsoft	16
Time Line, Symantec ★	16
Harvard Project Manager, Software Publishing	4
Time Line for Windows, Symantec	4
Others	29

29 percent of the respondents voted in this category

Accounting

Product, Manufacturer	% of votes
DacEasy Accounting, DacEasy	15
Quicken (DOS), Intuit	14
Pacioli 2000, M-USA Business Systems	12
Peachtree Complete III, Peachtree Software	10
QuickBooks, Intuit	9
Others	40

41 percent of the respondents voted in this category

Management Tool

Microsoft Project for Windows, Microsoft	6
Microsoft Excel, Microsoft	5
Microsoft Windows 3.x, Microsoft	4
Time Line, Symantec	4
Norton Desktop for Windows, Symantec	4
Others	77

21 percent of the respondents voted in this category

Most Promising Newcomer

OS/2 2.0, IBM	13
Windows 3.1, Microsoft	8
Stacker, Stac Electronics	6
Norton Desktop for Windows, Symantec	3
Microsoft Excel 4.0, Microsoft	3
Others	67

39 percent of the respondents voted in this category

Percentages rounded to nearest whole number; winners are determined by raw vote totals. ★ WORLD CLASS WINNER 1991. ☆ BEST BUY WINNER 1991 OR 1992.

WHERE TO BUY

14.4EX Modem
Intel Corp.
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AboveBoard 2 Plus
Intel Corp.
Reader service no. 766

AutoCAD
Autodesk Inc.
800/964-6432,
415/331-8093 (fax)
Reader service no. 767

Bernoulli Transportable 90 Pro
Iomega Corp.
800/777-6179,
801/778-3450 (fax)
Reader service no. 768

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Borland Int'l
800/331-0877,
408/439-9103 (fax)
Reader service no. 769

Central Point Backup
Central Point Software
800/445-4208,
503/690-8083 (fax)
Reader service no. 770

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Compaq Computer Corp.
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CorelDraw
Corel Systems
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Reader service no. 772

DacEasy Accounting
DacEasy Inc.
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214/250-3752 (fax)
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FormTool Gold
BLOC Publishing
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Reader service no. 776

Graphics Ultra
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Software Publishing Corp.
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Reader service no. 778

HP DeskJet 500
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Reader service no. 779

HP LaserJet III
Hewlett-Packard
Reader service no. 780

Jumbo 250
Colorado Memory Systems
800/432-5858,
303/667-0997 (fax)
Reader service no. 781

Lantastic
Artisoft Inc.
602/293-6363,
602/293-8065 (fax)
Reader service no. 782

Microsoft Excel
Microsoft Corp.
800/426-9400,
206/936-7329 (fax)
Reader service no. 783

Microsoft Mouse
Microsoft Corp.
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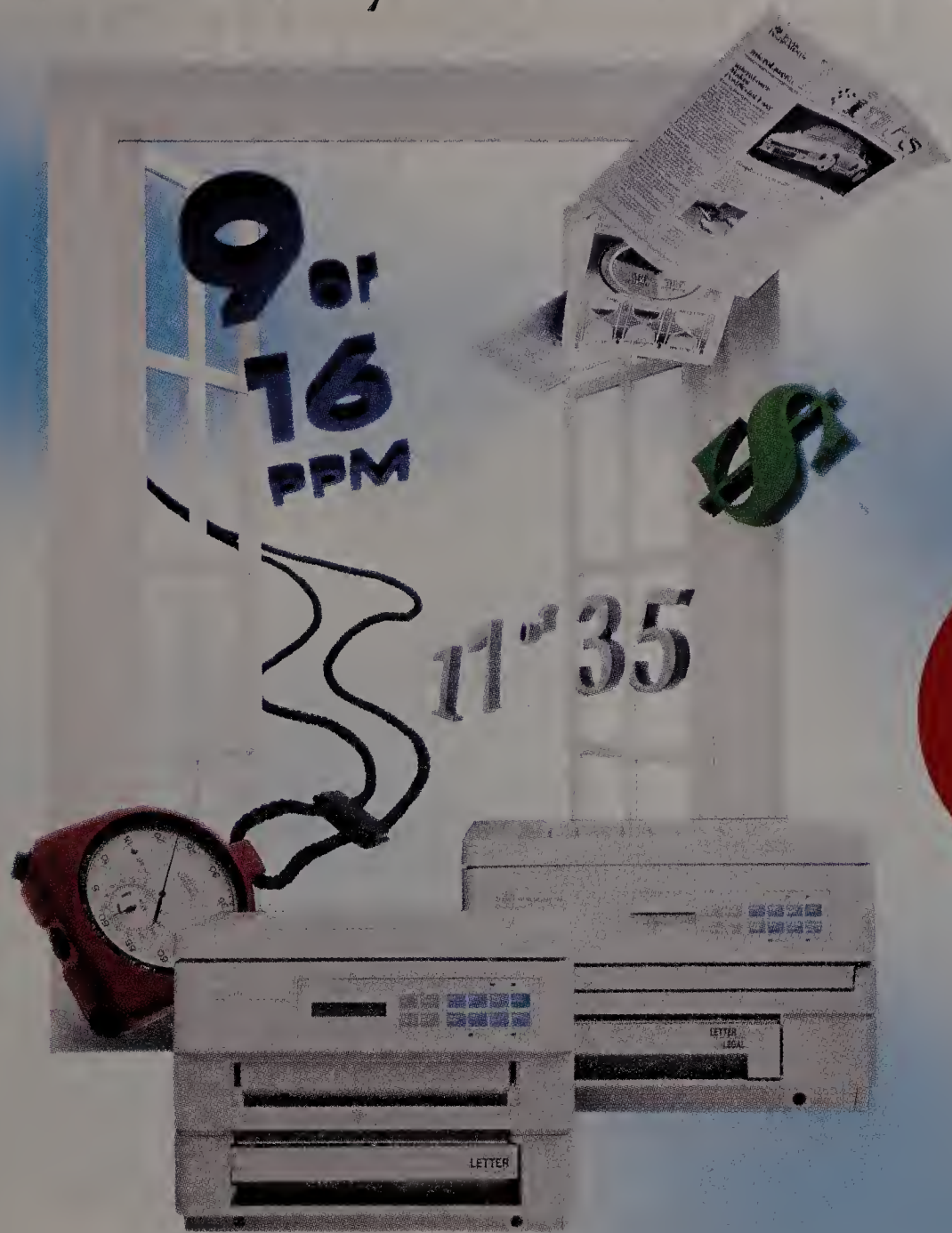
Microsoft Project
Microsoft Corp.
Reader service no. 785

Microsoft Windows 3.1
Microsoft Corp.
Reader service no. 786

Four reasons to buy a TI microLaser™ printer.



PS35 and Turbo models now priced lower!

Now there's a way for you to put the power of Microsoft® Windows™ on paper — microLaser from Texas Instruments.

Designed to be Windows-compatible, there's a microLaser just right for your needs, whether you need a personal or shared printer. Here's why:

MacUser ★★★★½

1. Compatibility With HP LaserJet® emulation and Adobe® PostScript® software, microLaser easily supports your demanding applications. And with our Microsoft Windows driver, set it and forget it with all Windows applications.

Not only does PostScript give you scalable outline fonts and graphics, it also means that your microLaser works in computing environments like Windows, DOS®, Apple® Macintosh®, OS/2® and UNIX®.

2. Performance When it comes to printing high-quality documents fast, microLaser really makes you look good. At either nine or 16 pages-per-minute, microLaser printers speed you through documents in a hurry. Plus PostScript means what you see on your screen is what you get on paper. You can even turbocharge your microLaser with a RISC processor for blazing fast graphics.

POSTSCRIPT® Software From Adobe

3. Reliability When you buy a printer, you want it to print. And print. And print. That's just what the microLaser does.

Take our personal microLaser Plus for example. With its high duty cycle of 10,000 pages-per-month* and a standard one-year limited warranty**, you can rely on your microLaser to work the first time, every time, for years.

4. Value Starting as low as $999†, there's a microLaser designed to fit any budget. From the single user all the way up to a network. Consider this, too: microLaser's average cost per page is only 1.9 cents‡, while some laser printers average around 3.3 cents. The microLaser not only makes sense, it saves you money, too.

For details on the right microLaser for you and the name of the nearest dealer, call

1-800-527-3500.

The microLaser PS17 has earned the 1990 PC World Best Buy award; microLaser PS35 has earned the 1990 InfoWorld Excellent Value award and 4½ mice from MacUser, October 1990.

Features	microLaser Plus Basic	microLaser Plus PS17/PS35	microLaser Turbo	microLaser XL Turbo
PPM	9 ppm	9 ppm	9 ppm	16 ppm
Emulation	HP LaserJet II	HPLJII/PostScript	HPLJII/PostScript II	HPLJII/PostScript II
Processor	68000	68000	RISC/8220	RISC/8220
Fonts	14 HP Fonts	17 or 35 Scalable	35 Scalable	35 Scalable
List Price	$999	$1,399/$1,499	$1,749	$3,649

TEXAS INSTRUMENTS

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Reader service no. 788

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Reader service no. 790

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Panasonic Communications and Systems
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Reader service no. 791

Paradox
Borland Int'l
Reader service no. 792

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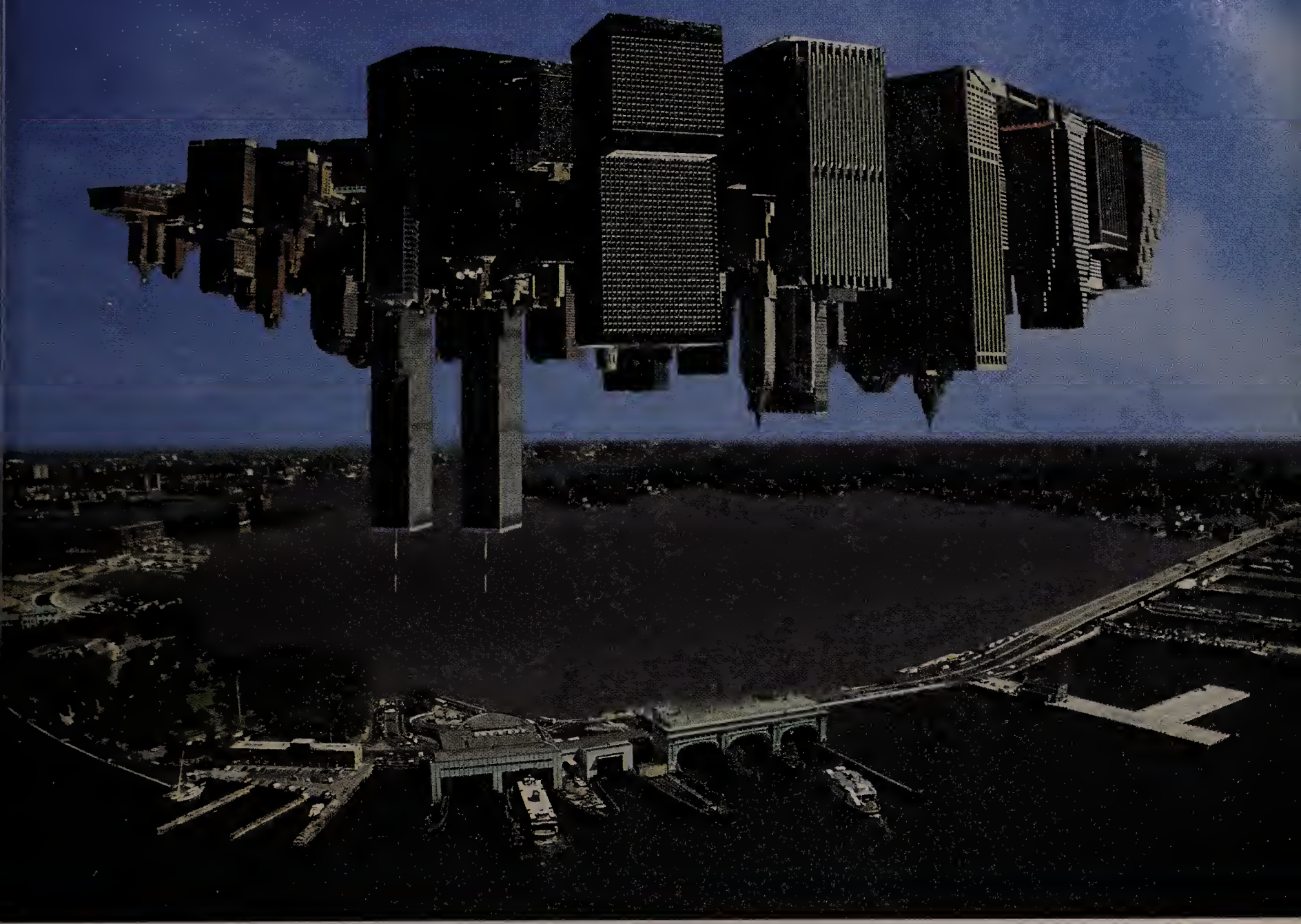

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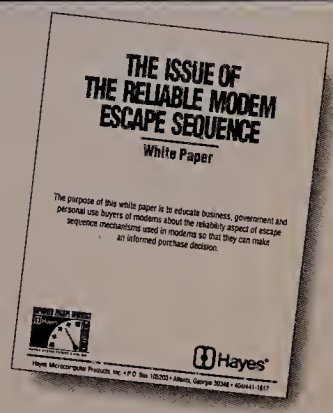

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Source: Reliability Ratings™ - 1992 PC Vendor Survey*

SERVICE		TECHNICAL SUPPORT		PRICE		RELIABILITY	
1. DELL	(8.63)	**1. DELL**	(8.09)	**1. DELL**	(8.82)	**1. DELL**	(8
2. APPLE	(8.06)	2. IBM	(7.99)	2. COMPAQ	(6.62)	2. COMPAQ	(8
3. IBM	(8.01)	3. APPLE	(7.72)	3. APPLE	(6.58)	3. APPLE	(8
4. COMPAQ	(8.00)	4. COMPAQ	(7.71)	4. IBM	(6.01)	4. IBM	(8

*Based on customer ratings from a sample of the 500 largest corporate PC sites in America.

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486P DESKTOP	i486 DX, 33 MHz	4 MB	170 MB	ULTRASCAN™ 14C	$2,299
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Survey was conducted by Reliability Ratings, Needham, MA. The data is quoted from a publicly available 40 page report. Reliability Ratings, the resea company, is not affiliated with Dell Computer Corp. and does not endorse its products.

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PLE	(7.64)	2. COMPAQ	(8.45)	2. APPLE	(8.08)	2. COMPAQ	(8.45)
MPAQ	(7.48)	3. APPLE	(8.40)	3. COMPAQ	(7.60)	3. APPLE	(8.14)
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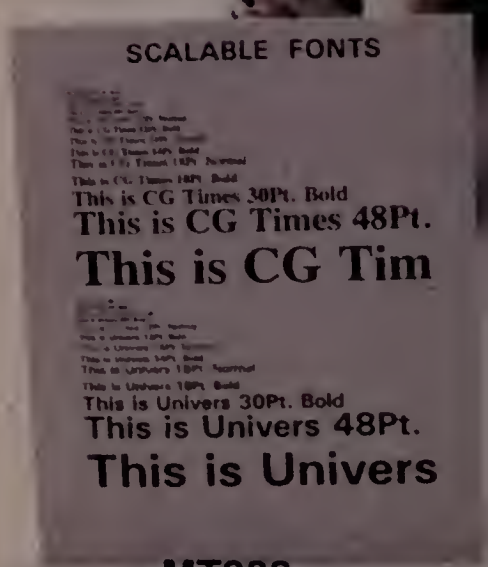
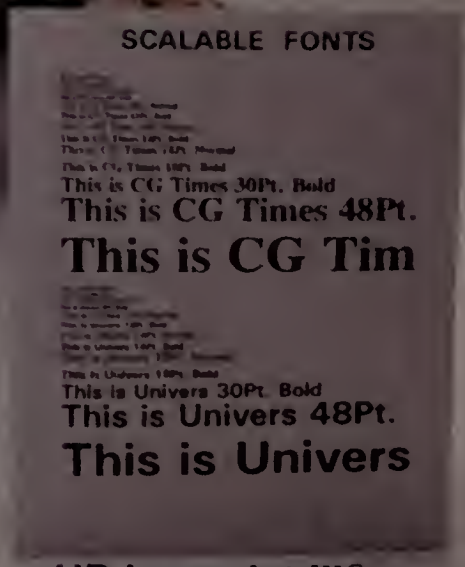


MT908



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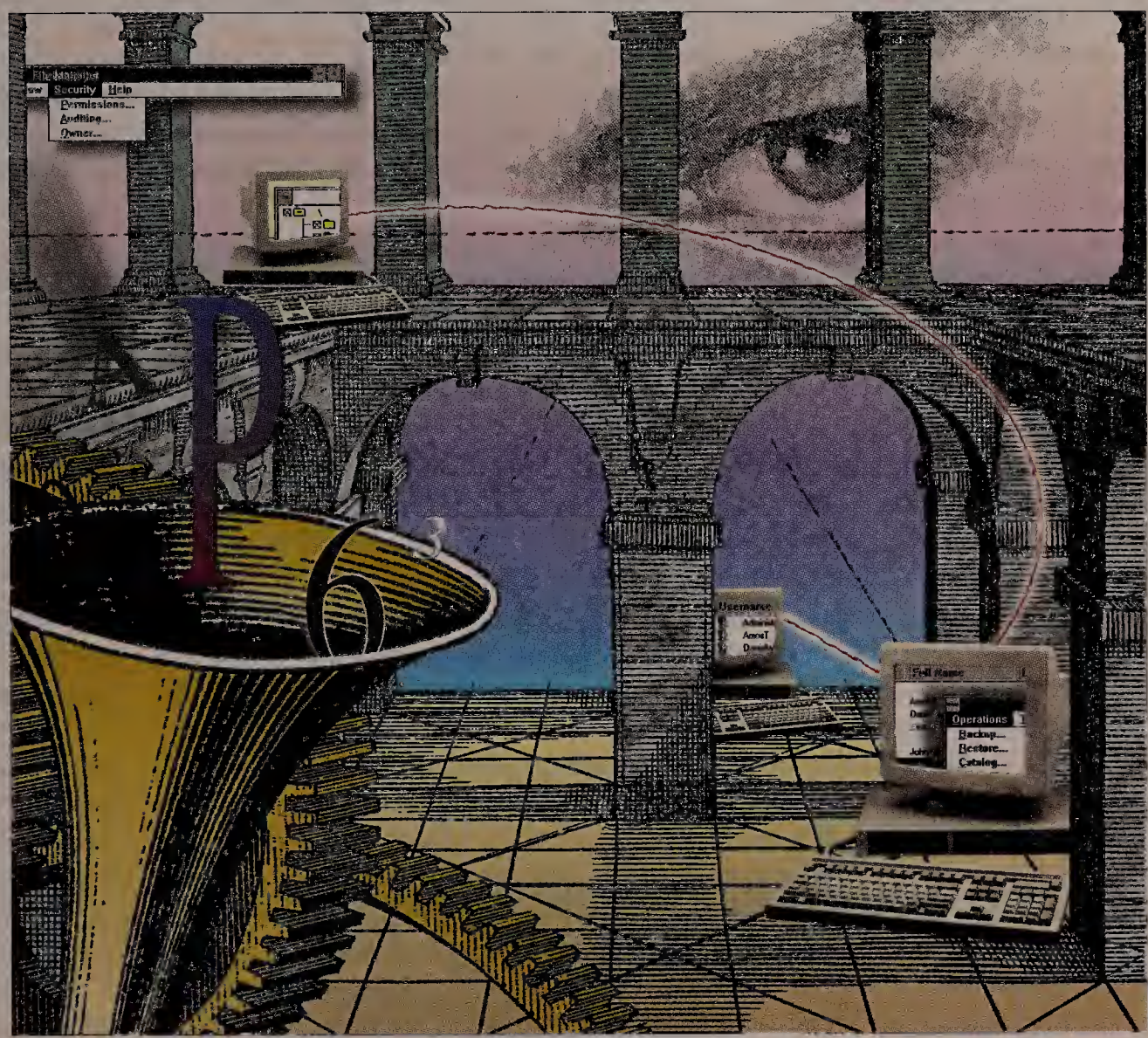
Windows NT:

A DOS for the '90s

After 12 years of DOS, Microsoft is launching a new operating system. Is this the Windows that users have been waiting for?



By Scott Spanbauer

DOS is like the faithful worker who's agreed to delay retirement. He'd love it if the company would bring in some younger blood, but they can't seem to find anyone to replace him. Worse, instead of simply letting him do what he does best, they've added *Windows* to his workload. It's the last straw: Shaky enough on its own, DOS really shows its age and instability when forced to act as *Windows*' chief means of support.

For a while it looked as if OS/2 might step in to replace both DOS and *Windows*. But imperfect *Windows* support, unresolved hardware compatibility problems, and a dearth of unique, native OS/2 applications have made it difficult for OS/2 to find much gainful work on people's desktops.

Along comes Windows NT 3.1, due to ship in the first half of next year. What the user sees looks like *Windows 3.1*. But just beneath the surface lurks new, industrial-strength code—plus built-in networking—that blends operating system and environment into a seamless, bulletproof whole—the "new technology" *NT* stands for. Windows NT is supposedly aimed at the top 10 percent of the PC marketplace, leaving

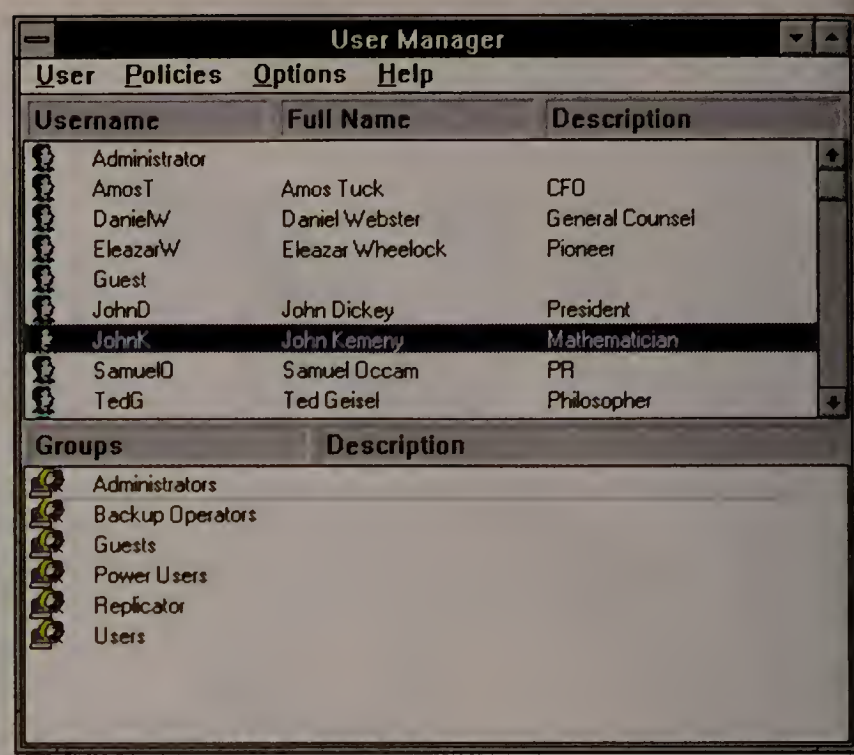
the remaining 90 percent to *Windows 3.1*. But Windows NT, if it delivers on its promises, is really what all-day *Windows 3.1* users crave: a stable operating system that lets you collaborate with others, while guaranteeing the security of your files. Equally alluring, it should run most *Windows* programs effortlessly, offer snappier response to user input, include integrated versions of *Microsoft Mail* and the group scheduling package *Schedule+*, and even let you assign 255-character file names.

All this comes at a price. Windows NT will require plenty of RAM and should devour more disk space than OS/2 2.0. In addition, though Microsoft has yet to announce pricing, the company's hinted that NT will cost in the $300 to $500 range. Before 1993 is over, however, plunging RAM and hard disk prices and the likelihood that NT will be an inexpensive upgrade from *Windows 3.1* or *Windows for Workgroups* (see the Test Drive in *Top of the News*) may make NT a tempting package.

The Stability Question

We looked at a preliminary version of the software, so we couldn't determine whether NT will overcome the instability problems—General Protection Faults and the like—that users still complain about in *Windows 3.1*. A quick look beneath the graphical veneer, however, suggests it should be rock solid: Windows NT is built on a 32-bit kernel capable of addressing 4 gigabytes of memory, a limitation you're unlikely to bump up against in this lifetime; DOS, the foundation for *Windows 3.1*, handles a maximum of just 1MB. When you run an application under NT, its memory is isolated; it can't get anywhere near the NT kernel, so even poorly written programs can't crash the system or overwrite memory used by others. *Windows 3.1*, albeit an improvement over *3.0*, still cannot protect the operating system from every rogue application.

At press time, details of Windows NT's most important feature—compatibility—were still unclear. Microsoft wouldn't guarantee that Windows NT will run every *Windows* program. It claims to handle DOS, OS/2, and even UNIX software, but not without limitations. Specifically, OS/2 support is minimal—NT runs only existing 16-bit character-based applications. And compatibility with all but the hundred or so best-selling DOS applications that Microsoft has promised to test isn't assured. Even if most do run, utilities like *SpinRite* and a number of the *Norton Utilities*, which bypass DOS and access hardware directly, definitely won't run under NT, though NT may not need those kinds of utilities. Additionally, Microsoft and the relevant hardware vendors will need to supply NT-compatible drivers for CD ROM drives, scanners, video cards, and the like—*Windows 3.1*–compatible drivers won't work. Fortunately, much of that work is well under way.



User Manager lets you control who may access resources on a specific machine and assign rights in a snap using predefined groups.

Perhaps the most exciting aspect of NT is the new class of applications that will exploit the operating system's special capabilities. Users will be treated to features such as multithreading, the capability to perform multiple tasks simultaneously within a single application. A multithreading version of *PageMaker*, for instance, could start im- porting a long text file and immediately let you paste in a piece of clip art without waiting for the task to finish. NT will also speed operations in the growing number of multimedia-laden applications, which must process unprecedented amounts of digitized video and sound without dropping a beat. Even with your existing *Windows* applications, NT will provide more reliable multitasking than *Windows* ever did, so you can print, download, and index files in the background. Although *Excel* won't load or print any faster than it does under *Windows 3.1*, you and your computer won't have to wait for it to finish before you can do other work.

> Server capabilities are built into every copy of NT at the operating system level, not layered on top (or missing) as in DOS.

Network Heavyweight

Networked offices, however, are where NT will really shine. Server capabilities—including file sharing, security, and auditing—are built into every copy of NT at the operating system level, not layered on top (or missing) as in DOS. This integration allows NT to take a fundamentally different approach to network configuration, combining the power and security of a traditional NetWare-style network with the flexibility and easy resource sharing that a peer-to-peer LAN affords. On an NT network, every machine can operate as both a client—accessing drives, printers, and processing on other machines—and a server—offering such services to other users.

Such capabilities may not spell the end for dedicated server–based LANs, which are hard to beat for high-performance file and print sharing. But NT's flexible power will likely change people's minds about peer-to-peer networking, which used to be reserved for smaller installations where security and brawn are not paramount.

Thanks to the new NT file system (NTFS), security across the network is tighter than on any DOS- or OS/2-based network. In fact, Windows NT's built-in networking conforms to the U.S. government's strict C2 security specification. Although ultimate security requires physical security—a determined sleuth could still

steal your hard disk, read its contents bit by bit, and reconstruct the files—no one without permission or a password can read your data through normal means.

Every time you use NT, you must log in. And no matter what you do or where you go, it knows who you are, what rights you have to change system settings, and what permissions you have to share files, directories, printers, ports, and so forth. Each machine can have multiple, password-protected user accounts, including a generic administrator account with full access, and a guest account with minimal rights and permissions. Windows NT saves desktops for each user account, along with shared variables and interface elements.

Of course, if every machine on a LAN operates as both client and server, user accounts, permissions, and shares must be set up on every system and maintained as users and resources change. Utilities included with NT should help administrators manage work groups—*domains* in NT parlance—without too much hassle. But what if your network spans multiple domains?

LAN Manager for Windows NT, a $500-plus management tool that Microsoft plans to release with NT, will ease the administrator's load by maintaining a database of single-user accounts for each domain (only one machine in each domain will need to run LAN Manager for Windows NT) and sharing it with other domains. LAN Manager for Windows NT will also enhance NTFS's fault tolerance, adding disk mirroring, drive duplexing, and a software implementation of the scary-sounding RAID 5 specification for supporting redundant arrays of inexpensive disks. RAID 5 will allow systems integrators and manufacturers to build highly fault-tolerant servers using off-the-shelf hard disks and skip expensive proprietary drive-array controllers. Should a RAID 5 drive suffer a defect or fail altogether, the server will be able to go on functioning without losing data.

A Host of Platforms

The networking that NT affords will extend to a wide variety of platforms, since Windows NT, and all the software it runs, should run on systems whose power rivals or surpasses the power of minis. For example, NT will work right out of the box on MIPS' R4000 RISC processor–based workstations such as the Magnum 4000; support for DEC's forthcoming 64-bit Alpha chip is promised; and compatibility with other CPUs can be added with only minimal rewriting of Windows NT's operating system kernel. Windows NT also supports symmetric multiprocessing, which allows multiple CPUs to divide and conquer computing tasks. Compaq has announced a system equipped with two 486 or next-generation Intel processors that will run NT, and several other companies have announced similar plans. This, combined with NTFS's fault-tolerant features, could make it the operating system of choice for the kind of real-time transaction processing crucial to firms now using minicomputers.

Installing a prerelease copy of NT consumed nearly 66MB on my 486 clone, thanks in large part to a 28MB permanent swap file!

Log In, Log Out

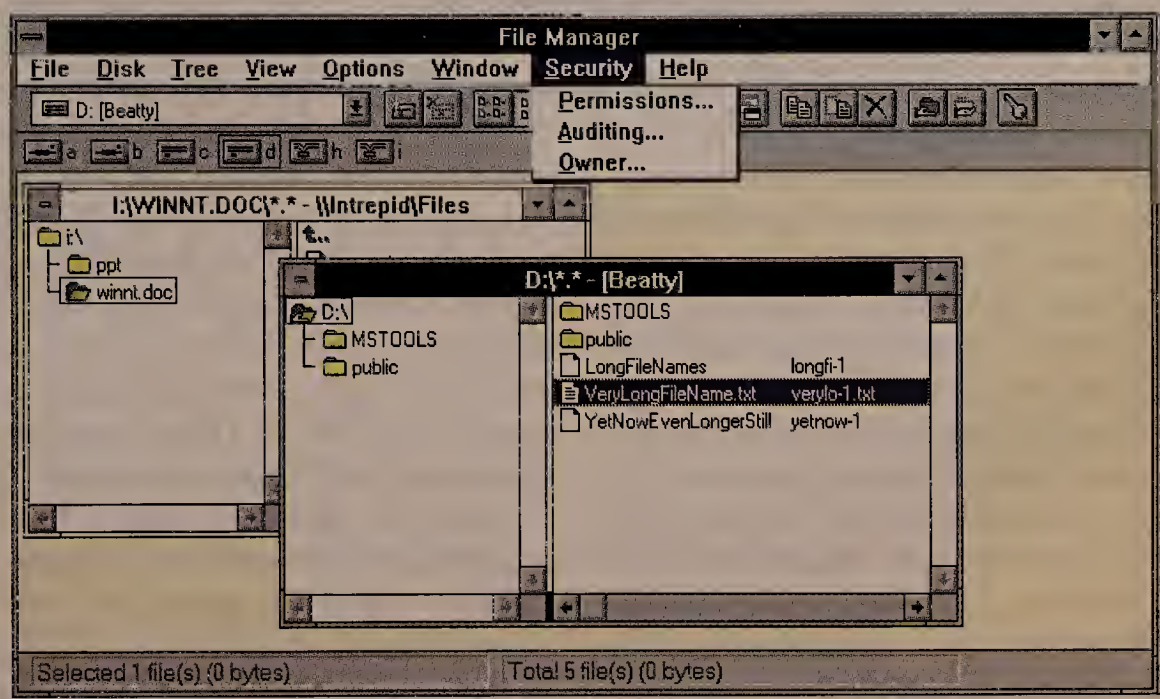
Installing Windows NT is pretty much like installing *Windows 3.1*, except NT asks you to insert 15 to 20 disks, as opposed to *3.1*'s 6. Fortunately, Microsoft will make CD ROMs available as well. Unlike its predecessor, however, Windows NT won't run on anything less powerful than a 386SX-based system and will require 8MB of RAM to run itself and several applications—comparable to OS/2 2.0's demands.

Disk space is another story; installing a prerelease copy of NT consumed nearly 60MB on my 486 clone, thanks in large part to a 28MB permanent swap file! Microsoft says the released version of Windows NT will still require a swap file in the 20MB to 30MB range. Disk compression won't be part of Windows NT's first release, though according to Microsoft, compression will appear in a subsequent version or through a third-party product.

The installation utility prompts you to enter a password and names for your computer and printer, to choose a supported network adapter, and to join a domain. After a reboot, a multiple-boot utility asks you to select any operating system you have on your hard disk—such as DOS, DR DOS, OS/2, or UNIX—from an on-screen list (you can later specify the default operating system and the length of time NT waits for your selection before booting it). If you select NT, the usual *Windows* wallpaper appears on screen, and a log-in dialog box prompts you to press a rather counterintuitive key combination—<Ctrl>-<Alt>-<Delete>—to log in. This security measure prevents electronic criminals from snatching your password with an identical-looking Trojan horse program. Enter your name and a password, and you're back on familiar turf.

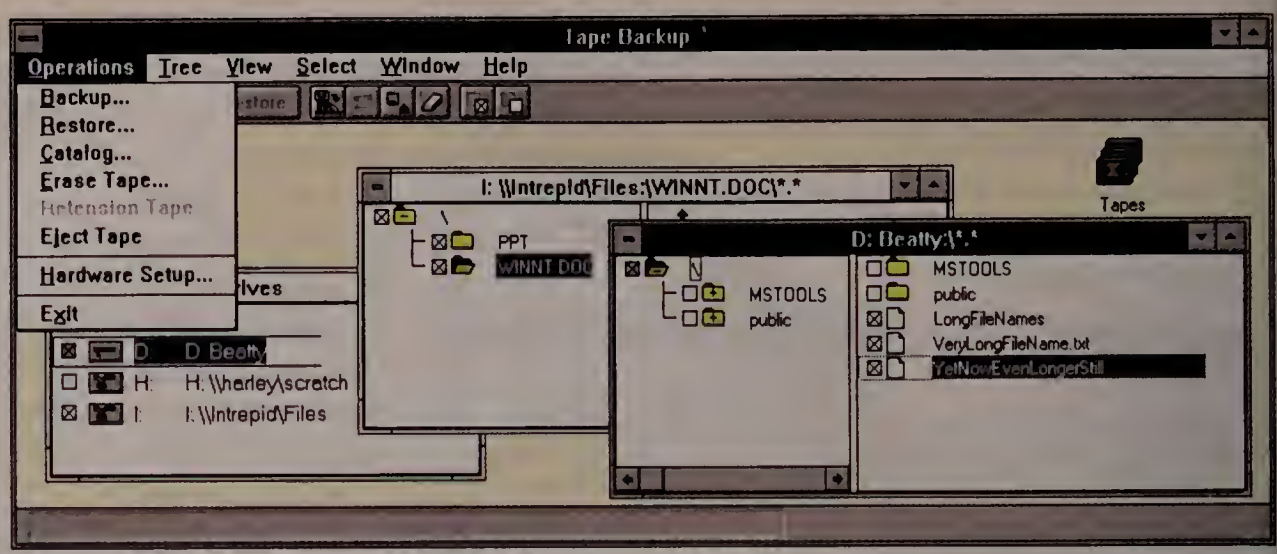
Windows Look-Alike

With few divergences, Windows NT looks and feels exactly like *Windows 3.1*. A quick tour of Program Manager reveals some differences, however. In addition to the groups that come with *Windows 3.1*, an Administra-



File Manager adds an icon bar of oft-used commands. The operating system accepts file names of up to 255 characters and generates unique DOS-compatible counterparts.

tive Tools group provides applications for managing Windows NT user accounts and NTFS partitions, a system performance monitor, and a backup utility for SCSI-based tape drives. In the Main group, File Manager gains a new button-bar interface, which includes options for sharing files and tracking access to them. Print Manager, formerly a print spooler many *Windows* users avoided, now lets you share local printers and connect to other network printers.



The preliminary release included DAT-compatible tape backup; support for other drive types is uncertain.

The Accessories group includes an upgraded Media Player capable of running Microsoft's new AVI-format audio-video files. The Games group, along with old favorites found in *Windows 3.1*, adds Freecell, a challenging variation of solitaire, and it may also include the networked Hearts game familiar to *Windows for Workgroups* users.

Windows NT's Control Panel, which now must handle many system settings formerly controlled by DOS's CONFIG.SYS and AUTOEXEC.BAT files, contains several new utilities: An NT System icon lets you set the default operating system and user-specific PATHs and environment variables (such as the location of the TEMP directory). The Server application gives administrators a single place to manage the File and Print Managers' shared resources and also displays currently active accounts and files. A Services utility, also meant for administrators, lets them configure LAN software such as Microsoft's upcoming Windows NT versions of *SQL Server* and *LAN Manager*, as well as other yet-to-be-announced third-party application servers. An uninterrupted-power-source monitoring program notifies users when a server running on battery backup power is about to shut down. The Network utility has been revised to reflect NT's built-in networking: It lets you install and remove support for adapters and connect to other networks and should include support for NetBEUI, TCP/IP, SNA, NetWare, DECnet, and OSI protocols.

> When will NT hit corporate desktops? Microsoft has intimated it will ship in the first half of 1993, but some industry insiders say late '93 is more realistic.

More Than DOS

Windows NT's command-line interface could pass for DOS, with some subtle differences. For instance, try typing DEL *file1.* file2.* file3.** at the DOS command line, and all you get are gripes about unexpected parameters. But not from NT, which deletes the files without a whimper by spinning off each operation into a separate processing thread. Equally welcome, the command window lets you set the number of screen lines and columns in its scroll buffer, ending the need for paging parameters and MORE pipes when viewing long files or directories.

Under Windows NT, all applications work together seamlessly, regardless which supported operating system they're written for or whether they're graphical or text-based. In fact, you can even launch graphical programs from NT's DOS-like command line interface, and specify that they load or run in the background by first issuing the START command. You could run your favorite lengthy DOS batch files and immediately launch *Ami Pro* without waiting for batch processing to finish. And *Windows* jockeys, rejoice: That bane of DOS-in-*Windows* compatibility, the PIF file, is gone forever.

Despite these capabilities, Windows NT's fate—taking the marketplace by storm like *Windows 3.1*, or languishing like OS/2—will depend in large part on the superiority of the applications written for it. Microsoft is funneling considerable resources into developer support, and claims that straight porting of 16-bit *Windows* applications to Windows NT is taking days or weeks rather than months or years. But while this simple porting will let users migrate to Windows NT with little pain, they probably won't see much improvement in application performance or functionality at first. Multithreading, one of the main innovations Windows NT applications can exploit, requires careful design and debugging to implement. The 32-bit flat memory access will speed up calculation-intensive programs, but not necessarily those that spend a lot of time displaying data.

At Home on Your Desktop?

Take all Windows NT's networking, file management, security, and multitasking charms—plus built-in *Microsoft Mail* and *Schedule+* groupware applications—and you have the makings of a powerful plug-and-play LAN. And if it proves as stable as it seems, its innate connectivity across the sort of mixed platforms prevalent in the corporate United States could put Windows NT on your desktop sooner than you think.

No one's quite sure if—or when—that will happen. Microsoft has intimated that NT will ship sometime in the first half of 1993, though some industry insiders have suggested late '93 is more realistic. As Windows NT moves through its development cycle, *PC World* will give you definitive reports on how well it stacks up against DOS and OS/2 and how well it runs key DOS and *Windows* applications. If Windows NT passes muster, maybe DOS can start thinking about retirement after all.

Scott Spanbauer is a contributing editor for PC World. *He can be reached on PC World Online (see page 8 for more information).*

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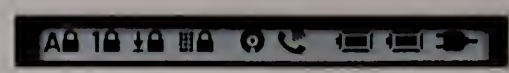

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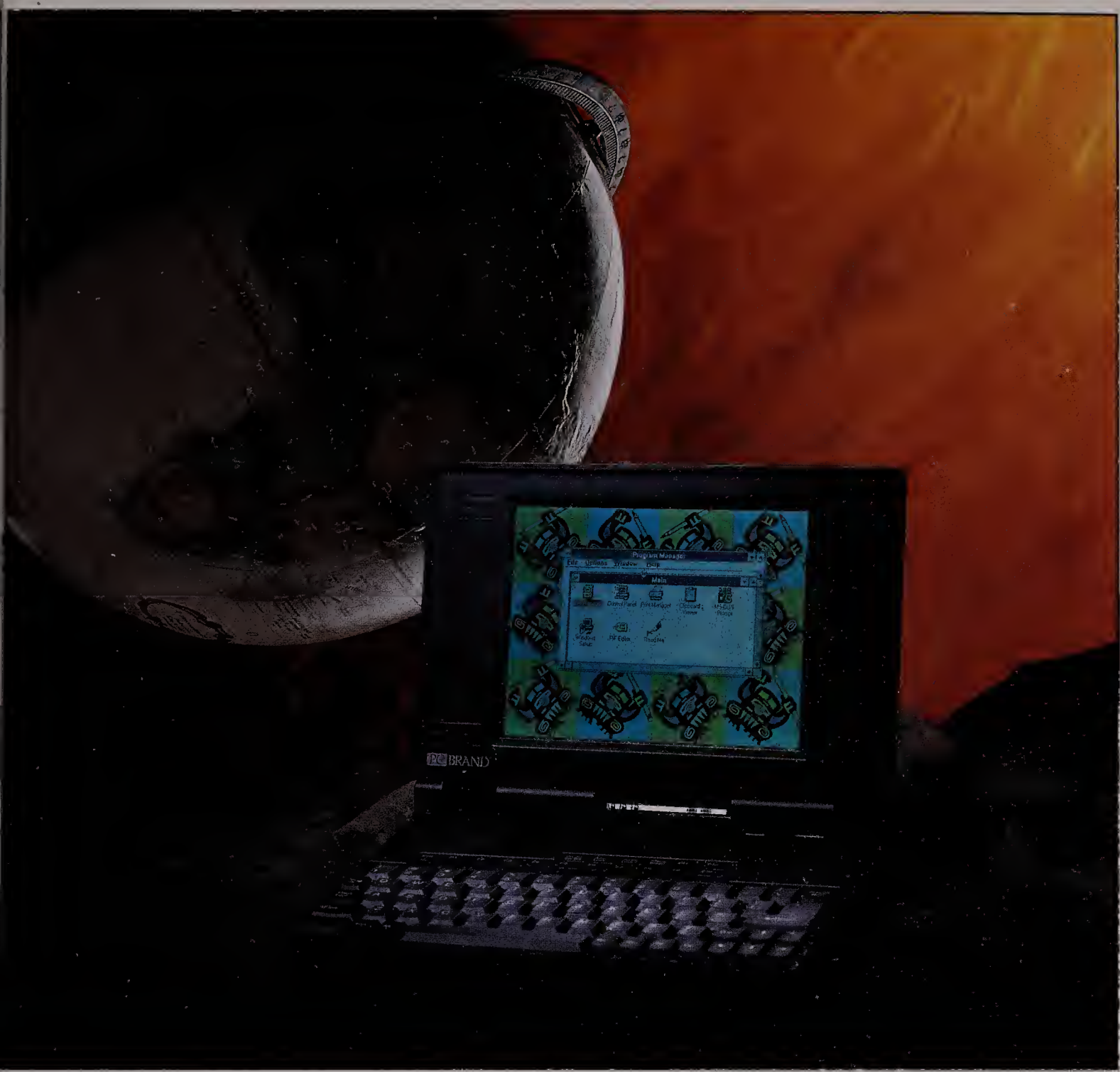

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A Window on the Network

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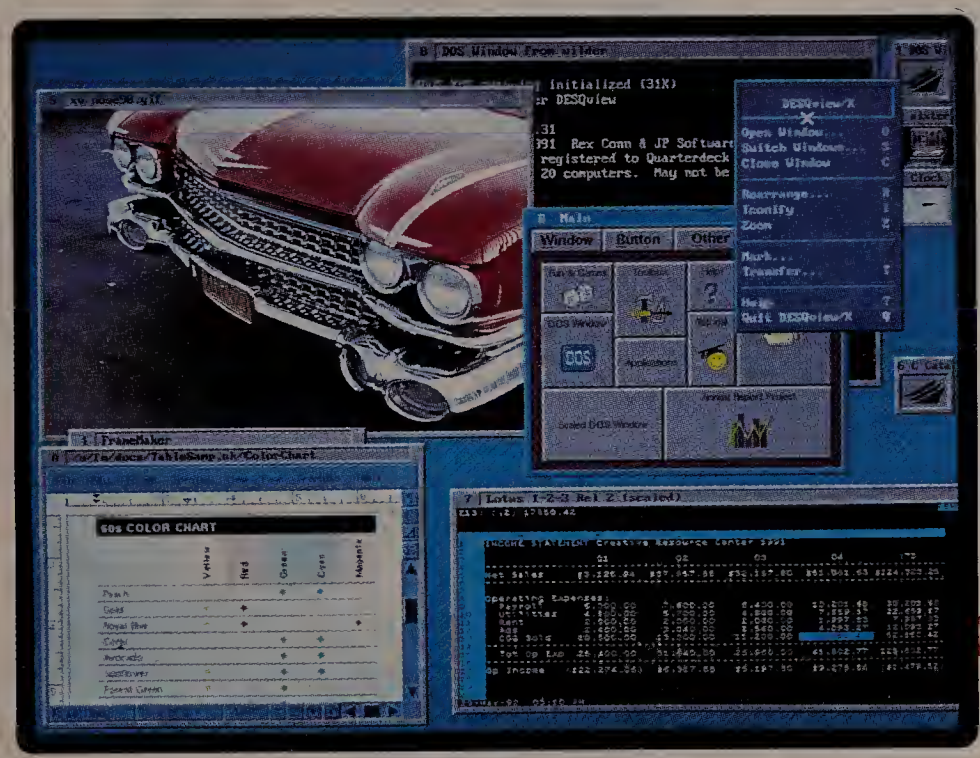
example to the right, l-2-3 is running in its own PC. The window at the top of een is a DOS window g on a remote 486 PC under view/X. At the lower left is a Maker program running on a IBM RS/ 6000 workstation in r part of the company.



rand and Platform Freedom

view/X runs on 386SX PCs ove. And from within ws on those PCs, you can rograms* running on any number of remote DESQview/X PCs if etwork supports NetWare or NetBIOS. Add DESQview/X's al Network Manager for TCP/IP networks and you can also access ams running on IBM RS/6000s to HP 9000s to Sun workstations. t works the other way, too: these workstations can view and use programs in their displays.

raphics programs currently run only on your local PC.

Works the Way You Want

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486SX-25s *vs.* 386DX-40s

The Upstart Fights Back

Is the 386 dead? Not if AMD has anything to say about it. In a shoot-out between 15 AMD 386DX-40 systems and 15 Intel 486SX-25s, the 386s prove there's life in the old chip yet.

The world was once a simpler place: PCs used Intel processors. A 486 was faster than a 386. 33 MHz was faster than 25 MHz.

Things aren't so clear-cut anymore. Thanks to such upstart companies as AMD and Cyrix, PC vendors now have alternatives to Intel chips. In response to the competition, Intel is flooding the market with new processors; at last count it had 31 chips on the market, from the 16-MHz 386SX to the powerful new 66-MHz 486DX2. Unfortunately, with all these new chips available from Intel and the others, it's virtually impossible for the average buyer to keep them all straight.

Nowhere is this confusion more keenly felt than in the heart of the PC marketplace—mainstream business computing for which 386SXs are too little and 486DX2s too much. Intel is positioning its 486SX-25 as the new entry-level processor for mainstream business applications; not coincidentally, that's the same market segment that other chip makers,

by Owen Linderholm and Dan Miller

Best Buys

The top three systems here—the Compudyne, the Blackship, and the Eltech—stand out a little more than the rest of the systems in the review. After these three, the next dozen or so systems are fairly close to one another in overall value. The QSI and Packard Bell head up this group and are followed by the Standard, the USA Flex, the Sai, the FastMicro, the PowerBox, the Tangent, the Bell, the Auva, the CompuAdd, and the Swan.

1. Compudyne 486SX/25
2. Blackship BLK 386/40
3. Eltech Model 3400
4. QSI Klonimus 386/40
5. Packard Bell 486SX/25

Best Price

Most of the cheapest systems in this review are 386DX-40s, but the 486SX-25 from Compudyne, at $1599, edged its way into the top five, and Packard Bell's 486 wasn't too far behind it. Besides the Packard Bell, the 386-40 machines from PC Brand and QSI also just missed the top five for price. The 486 from Gateway 2000, at $1895, was three places behind the Packard Bell, and Mitac's 486 was four places behind that, at $2042.

1. Eltech Model 3400
2. Compudyne 486SX/25
3. FastMicro FastData 386/40
4. Blackship BLK 386/40
5. Sai 386DX-40

including AMD and Cyrix, are pursuing with their new processors.

So which chip is right for *your* mainstream computing needs? To find out, we decided to take a look at 15 systems using the 25-MHz 486SX and 15 using AMD's 40-MHz 386DX.

Drawing the Price/Performance Curve

We started by comparing the systems by price. We called dealers around the country and asked them to quote us a price on a system in our standard configuration: a 100MB to 200MB hard drive, 8MB of RAM, a super-VGA video adapter and color monitor, serial and parallel ports, a keyboard, a mouse, DOS, and *Windows*.

The trend was hard to miss: With few exceptions, systems using the 386DX-40 were far less expensive than those using the 486SX-25. The average price for a 386-based system was less than $2000 on the street; the average price for a 486SX was around $2700. Four of the five least expensive systems were 386s (the fifth was the $1599 Compudyne 486SX/25). The systems from Compudyne, Gateway 2000, Mitac, and Packard Bell were the only 486SXs whose prices were below the average for *all* the reviewed machines.

The tables turned when we put the machines through our performance tests. The 486SXs recorded clearly superior times on our application-based benchmarks: On average, the Intel-based systems were 10 percent faster than the AMD-based ones.

All five of the fastest systems in the review are 486SXs. A 386 from PC Brand came in eighth, but its high overall ranking was due solely to its blazing, math coprocessor–enhanced performance on our *1-2-3* test. The PC Brand was followed immediately by two other 386s, the Acma and the Arche. These three were the only 386s whose overall performance was above average for this review.

The 486SX group's 10 percent overall performance advantage over systems using the AMD chip may not seem like much, especially when the average 486SX system costs 40 percent more. So what's the advantage of buying one? In a word: upgradability.

Charting the Upgrade Path

Every 486SX system here gives you the option of moving up to a more powerful processor. Only two of the 386s—the FastMicro and the PC Brand—are upgradable at all; the FastMicro's motherboard has an adjustable clock and sockets for every processor from a 386DX all the way to a 486-DX-50, while the PC Brand uses removable CPU cartridges.

A third of the 486SX systems use replaceable stand-alone processor cards that hold the CPU, memory modules, BIOS, and system clock; to upgrade, you buy a proprietary replacement card from the vendor. With the processor-card method, you can upgrade to any processor for which the vendor offers modules.

Another third of the 486SXs let you replace the original CPU. This upgrade path requires an adjustable clock. Some clocks reconfigure themselves automatically when you insert the new processor; most, however, require you to switch some jumpers manually.

One other possibility: Remove the original processor and replace it with the 168-pin version of Intel's 25/50-MHz 486SX OverDrive chip. The OverDrive is also an option for the final third of our 486SX systems, which are equipped with the Intel upgrade socket; in this case, you'd need to install the 169-pin version of the OverDrive.

Adding an OverDrive to a 486SX should improve performance by up to 70 percent on general business applications and over 300 percent for applications laden with mathematical functions. At press time Intel was preparing to announce price cuts on the OverDrive that should reduce the street price from the current $629 average to somewhere between $450 and $500. In our November review of OverDriven 486SXs, we found that adding the OverDrive chip to these systems, even at the $600 level, was a dramatically cost-effective way to improve their price/performance balance.

So you have a choice: On the one hand, the 386-40s give you a good mix of low price and reasonable performance, but for the most part they're a dead end. On the other hand, unenhanced 486SXs are not as attractive on a price/performance basis, but they can be improved with the help of a new CPU.

On every other count besides price and performance, these groups of systems are

Best Performance

This review was almost evenly divided between the 486SX-25s and the 386DX-40s on performance. Only three 386s made it into the top ten, led by the coprocessor-boosted PC Brand. Despite this, the difference between the slowest system and the fastest was only 32 percent. The ability to drop in an OverDrive, however, does give the 486SX-25s the chance for a significant performance boost.

1. Boss 486SX/25 Cache
2. AST Power Premium 4/25s
3. ALR Flyer 32DT 4SX/25
4. Dell 486D/25
5. Compaq Deskpro 4/25si

Best Service and Support

Service and support for PCs is gradually improving. Over half the systems here received very good scores for their service policy and their company's responses to sample customer inquiries. The bad news is that the companies that do poorly do a lot more poorly than those with better service and support. Our top five all earned great ratings, as did the systems from Auva, Boss, ALR, Acma, PowerBox, Standard, PC Brand, Compaq, and Olivetti.

1. USA Flex Flex 386/40
2. Eltech Model 3400
3. AST Power Premium 4/25s
4. Blackship BLK 386/40
5. Tangent Model 340

equivalent. For example, most of the systems, no matter which processor they use, come with accelerated super-VGA graphics (which is rapidly becoming standard equipment on most new PCs). Similarly, all but five of these systems come with some form of memory cache.

No matter which type of system you buy, your choice of slots and bays will depend on what you're using the system for. In a standalone unit, six free slots and five bays should be plenty. If, on the other hand, you'll be hooking up the system to a local area network, four free slots and three free bays should suffice. It's important to note that slots aren't much good if access to them is obstructed by other components.

Insurance Policies for the Nineties

In addition to price, performance, and design, we looked at the service and support you get with these systems. We placed anonymous calls to each vendor's tech support line, asked their staff a series of typical customer queries, then rated their answers on the basis of responsiveness, courtesy, accuracy, and thoroughness. We also rated each company on the length of its system's warranty, the cost (if any) of its on-site service (if any), and the turnaround policy for repairing systems.

All the systems in this review come with at least a one-year warranty; Arche, Boss, PowerBox, QSI, Standard, and Swan give you two years, while Sai gives you three. Once again, as in our November review, a FastMicro machine—which would otherwise have been a Best Buy in this roundup—was penalized because of the number of complaints our *Consumer Watch* department has received recently about the company and because of its poor showing in our November service-and-support survey.

When it came time to pick our five Best Buys, we combined our findings on price, performance, design, and service and came to one inescapable conclusion: With only a few exceptions, systems based on the 386-40 represent better values than those using the 486SX-25.

With only a few exceptions, systems using the 386-40 represent better values than those using the 486SX-25.

That said, our overall Best Buy is the 486SX-25 from Compudyne. It managed to balance both speed and price: It was only 8 percent slower than the fastest machine here, while costing just 8 percent more than the least expensive. It also scored well on design, and its service and support was good. Because it hit that balance just right, it's the best machine in the roundup.

The second, third, and fourth spots were all taken by 386s. The Blackship and the Eltech were in the top five for price, had acceptable speed, and were backed up by superior customer service. The fourth-place QSI, like the Compudyne, earned its honors through a balanced showing in every category. Fifth place was taken by another 486SX, the Packard Bell, which was the second cheapest 486SX (after the Compudyne) and only 7 percent slower than the fastest system in the review.

After the Compudyne and the Packard Bell, however, the 486SXs fared poorly in our overall ratings; the next closest Intel-based system (the CompuAdd) was ranked 14th. Of the bottom 15 systems, only 4 were 386s. However, we should point out that after the top 3, numbers 4 through 15 were very close in overall quality.

Despite the 386's dominance in our overall standings, there's still one compelling reason to go with a 486SX—upgradability. However, if you're more interested in what you can do with a system *now*, it's hard to argue against the 386-40s. Most of them give you the same features as the 486SXs at only slightly slower speeds, and for far less money. It just goes to show that where the business buyer's budget is concerned, the race doesn't always go to the swift—it sometimes goes to the cheap.

Owen Linderholm is a senior editor and Dan Miller an assistant editor for PC World. *They can be reached on PC World Online (see page 8 for more information).*

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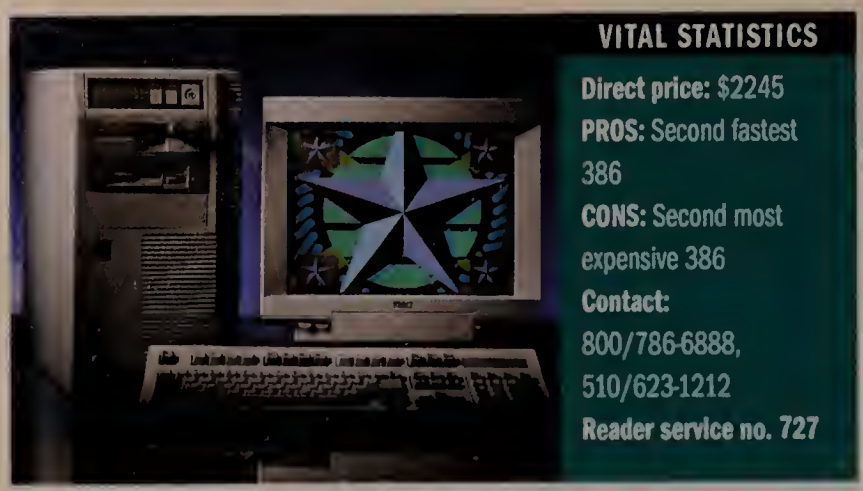


VITAL STATISTICS

Direct price: $2245
PROS: Second fastest 386
CONS: Second most expensive 386
Contact: 800/786-6888, 510/623-1212
Reader service no. 727

Acma 386-40

For a 386, the Acma 386-40 is fast—in fact, it's the second fastest 386 we tested (after the PC Brand), and the ninth fastest machine of any kind overall. This system did particularly well on disk-intensive database tests, running just 6 percent behind the fastest system on our *dBASE* benchmark and finishing a close third on *Paradox;* it also scored well on our *Windows* test.

Unfortunately, the speed and other attractive features don't come cheap—this is the second most expensive 386 here. Of course, at $2245, it costs far less than many 486SX machines. That drawback aside, if you want a fast 386, the Acma is worth considering. If speed is what you're looking for, however, a 486SX-25 system is probably a better idea.

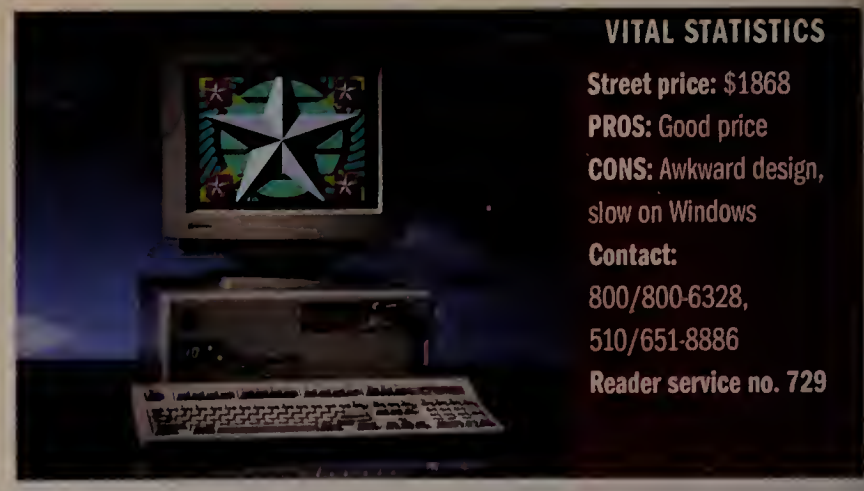
VITAL STATISTICS

Street price: $2977
PROS: Third fastest system in review
CONS: Expensive, limited expandability
Contact: 800/444-4258, 714/581-6770
Reader service no. 728

ALR Flyer 32DT 4SX/25

The ALR Flyer 32DT 4SX/25 is typical of the 486SXs in this review. For one thing, it's fast. It flew through our benchmarks, tying for the top spot on our *dBASE* and *Windows* tests, tying for second behind the PC Brand on *1-2-3*, and placing near the top on *WordPerfect*. It was the third fastest system overall. Also, like the other 486SXs, it's upgradable. In this case, to upgrade you must buy a proprietary processor card, which holds the appropriate system clock along with the new CPU.

Unfortunately, like the other 486SXs, the Flyer is expensive. In fact, at $2977, it's one of the most expensive systems in the roundup. Also, for all that money, you get only one internal and two externally accessible drive bays (the internal is occupied by a generous 212MB Maxtor hard drive). If you want top speed but don't want to shell out the $3300-plus required for the fastest machines here, you might consider the ALR Flyer. There are, however, better values to be had.



VITAL STATISTICS

Street price: $1868
PROS: Good price
CONS: Awkward design, slow on Windows
Contact: 800/800-6328, 510/651-8886
Reader service no. 729

Amax 386-40 ISAmax Power Station

The Amax 386-40 ISAmax Power Station is a consistently slow machine—it posted below-average times on every benchmark in our test suite. It was particularly slow on *Windows*, which surprised us since the system comes with a speedy S3-based video board.

In addition to being slow, the Amax has problems with design and layout. The coprocessor socket is located under the drive bays, so the only way to install a math coprocessor is to completely remove the entire drive apparatus. The Amax is also one of the few systems not to integrate any of the video, disk control, or I/O components on the motherboard, which means that three of the six 8/16-bit slots are occupied by controller boards. The unit has four externally accessible drive bays, three of them occupied (one by a Seagate hard drive).

In its favor, the Amax is competitively priced, a bit below the average of the 386s we reviewed and 20 percent below the average of all the systems here. However, less expensive systems are available, including some that are faster. With limited upgrade and expansion possibilities, the Amax is hard to recommend.

VITAL STATISTICS

Street price: $3260
PROS: Fast, 128K cache
CONS: Expensive
Contact: 800/437-1688, 510/623-8100
Reader service no. 730

Arche Legacy 386/40

The Arche Legacy 386/40 is right up there with the fastest systems in this review. It ranked third among the 386s and tenth overall. On our *dBASE* test, it was a mere 2 percent slower than the top two systems, and it tied for second place (4 percent behind the top machines) on our *Windows* benchmark. In addition to speed, it gives you a nice 128K cache, a 203MB Western Digital hard drive, and four free 8/16-bit expansion slots. So what's wrong with it? The price. At $3260 on the street, it's the most expensive 386 machine in the roundup. For that money, you could get yourself a faster 486SX. Considering the 486SX's upgradability, that is precisely what we'd recommend that you do.

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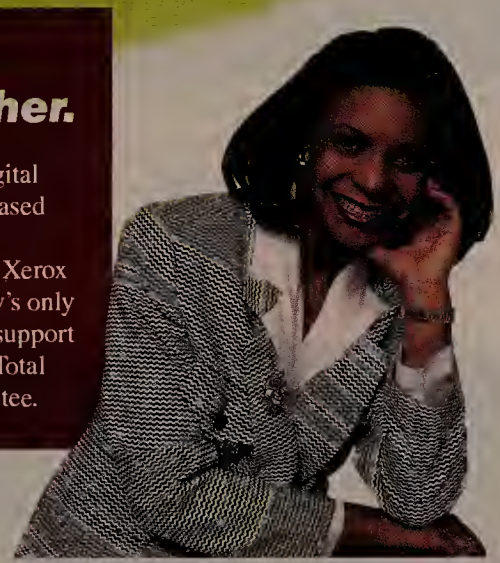

Tammy M. Johnson
Xerox Account Representative

Color documents were always of supreme importance to the people at this world-famous movie and publishing company. In fact, they spent thousands per month on outside color opying services. They wanted their own machine but no ne had put together the kind of performance and support ıey needed. Then Tammy Johnson and the Xerox team ıtroduced them to the Xerox 5775 Digital Color Copier.

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Circle 248 on reader service card

VITAL STATISTICS
Street price: $3452
PROS: Fast, excellent customer service
CONS: High price
Contact: 800/876-4278, 714/727-4141
Reader service no. 731

AST Power Premium 4/25s

The AST Power Premium 4/25s is the only EISA system here, which explains the high price. To balance that, you get the potential for using higher-performance peripherals. It's also one of the fastest systems here: It tied for first place on *WordPerfect* and for second on *Windows* and *1-2-3*, and it was the second fastest machine overall.

Like the rest of the Power Premium line, the 4/25s uses AST's Cupid backplane architecture, which puts the CPU, system clock, BIOS, and memory on a card inserted into a dedicated 32-bit slot. Two more of these Cupid slots are available for memory upgrade boards, which can each hold 32MB of fast RAM. These boards, combined with the 16MB on the processor cards, give you a whopping 80MB total. The AST also has a big 234MB Quantum hard drive.

What's even nicer is that the intelligence behind the design extends to service and support. Our questions were answered quickly and correctly, and the lines are open 14 hours a day, plus weekends.

It doesn't take a genius to figure out that all this hot performance, cool design, and attentive service doesn't come cheap. The AST is the second most expensive system here. If you want top speed and expandability, the AST is compelling; if you want the best value you can find, keep looking.

VITAL STATISTICS
Street price: $2046
PROS: Good expandability
CONS: Second slowest system
Contact: 800/879-2882, 708/832-3276
Reader service no. 732

Auva 386/40

The Auva 386/40 is neither fast nor cheap. Its standout feature is expandability: It has a 64K cache, upgradable to 256K; five of eight 8/16-bit slots free; seven externally accessible drive bays (five 5¼ and two 3½); and three internal bays (one 5¼ and two 3½) in a full-size tower case.

Besides room for expansion, however, there's little to recommend the system. It was the second slowest here, with particularly slow times on our *dBASE*, *1-2-3*, and *WordPerfect* tests. Though it's cheaper than some of the other systems here, the money you save doesn't make up for the performance you lose.

VITAL STATISTICS
Street price: $1999
PROS: Room to expand
CONS: Slow performance
Contact: 800/542-2355, 818/909-3529
Reader service no. 733

Bell BSP 1340

The Bell BSP 1340 is a nicely designed 386 that fared poorly on our performance tests. It was the second slowest system on our *Paradox* benchmark, near the bottom on *WordPerfect* and *Windows*, and overall was the third slowest machine in the review. However, it does pack some nice expandability options—a 64K cache, upgradable to 256K; five 8/16-bit and two 8-bit expansion slots (one of which is obstructed by a drive bay)—in the minitower case. Documentation is sometimes incomprehensible, and the case feels flimsy. If the price were lower, this machine might be worth consideration; as it is, there are better systems to be had.

VITAL STATISTICS
Direct price: $1645
PROS: Low price, room to expand, good service and support
CONS: Slow
Contact: 800/531-7447, 408/432-7500
Reader service no. 734

Blackship BLK 386/40

The Blackship BLK 386/40 is an excellent example of good value packed into an inexpensive system. At $1645, it's the fourth cheapest unit here.

Despite the low price, you still get plenty of bang for the buck. Expandability doesn't cost much, so Blackship gives you a 64K cache, upgradable to 256K; seven 8/16-bit slots (six of them free, one obstructed by the I/O ports); and seven drive bays (four externally accessible in both 5¼- and 3½-inch sizes and three internal 3½s).

You also get unusually good service and support; our researchers described Blackship's tech support as "practically perfect in every way." The company offers a year of free on-site service and a two-day turnaround policy. Its phone lines are open 9 hours a day.

The only downside comes in performance. The Blackship was close to being the slowest system on our *1-2-3*, *Paradox*, *Windows*,

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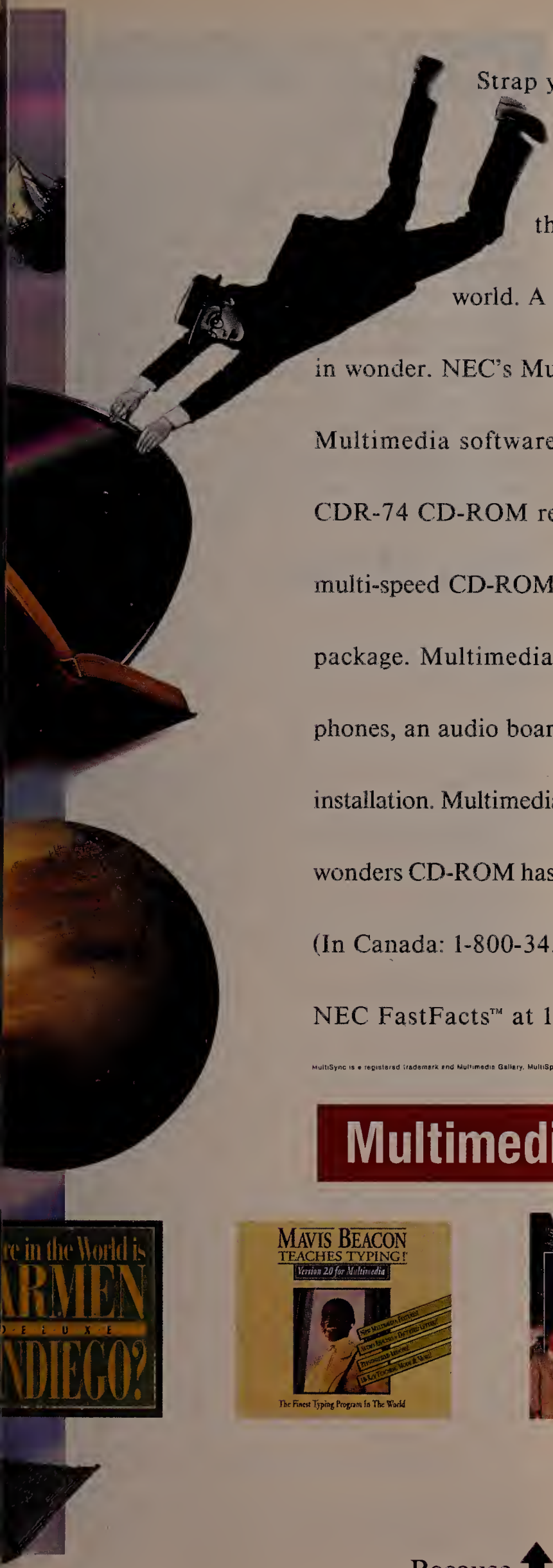
Harold Lloyd photo courtesy of Harold Lloyd TrueVFPG



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and *WordPerfect* tests; it was the fifth slowest overall. Otherwise, this machine gives you a nice set of features for a reasonable price—enough to make it an easy pick as one of our Best Buys.

VITAL STATISTICS

Street price: $3333
PROS: Fastest system in review
CONS: High price
Contact: 800/628-1787, 404/636-2126
Reader service no. 735

Boss 486SX/25 Cache

If you want speed, the Boss 486SX/25 Cache is your machine: The fastest system in this review, it finished first on our *Paradox* test, tied for first on *WordPerfect* and *Windows*, tied for third on *1-2-3*, and was a mere 1 percent behind the front-runners on *dBASE*.

Speed isn't all the Boss gives you—it has a 64K cache, expandable to 256K; six out of seven 8/16-bit slots free; and a generous six drive bays (one of them filled with a capacious 239MB Seagate hard disk). Upgrading the CPU is easy: Drop in a new CPU, change a few jumpers, and you're done. Service and support is also decent: You get two years of free on-site service and a two-year warranty.

But once again you have to sacrifice price for speed—at $3333, this is the third most expensive system here. Still, if you're looking for speed and upgradability, the Boss is well worth considering.

VITAL STATISTICS

Street price: $3251
PROS: Designed for speed
CONS: High price
Contact: 800/345-1518, 713/370-0670
Reader service no. 736

Compaq Deskpro 4/25si

The Compaq Deskpro 4/25si really stands out from the crowd. For one thing, it's fast—fifth fastest overall, just 4 percent behind the fastest on our *dBASE* test, and tied for third on *1-2-3*. Also, it's designed better than almost any other system here. Mass storage is handled by a generous 210MB Conner hard drive, and Compaq has incorporated Business Audio sound hardware on the motherboard, along with excellent QVision graphics.

Given the speed and design smarts on display here, we probably shouldn't have been surprised to find that the Deskpro is a pretty pricey machine. In fact, at $3251 on the street, it's the fifth most

Late List Prices

If you need more proof that the PC marketplace is still in turmoil, take a look at some of the price reductions that took place between our initial pricing research in August and our final check in October. Why the big price changes? The Tandy 4825 SX is a prime example of the number one reason: cutthroat competition. Since we checked with the company last summer, Tandy has cut this system's list price nearly 30 percent as part of an effort to stay competitive with the mail-order houses. Companies such as Gateway 2000 are actually introducing leaner, meaner versions of their old systems; its current 486SX-25 is in fact an entirely new system that replaced the 486SX we reviewed. Because of these price changes, some of our overall rankings would be different if we wrote this review today. The USA Flex, for example, would move up into the top five overall. The Bell and the Gateway also become more attractive, if not quite top five material.

Prices Still Falling

	List price as of October 1992	Price drop from August 1992
Acma 386-40	$2245	none
ALR Flyer 32DT 4SX/25	$3436	none
Amax 386-40 ISAmax Power Station	$1895	none
Arche Legacy 386/40	$2650	$980
AST Power Premium 4/25s	$3640	none
Auva 386/40	$1948	$150
Bell BSP 1340	$1899	$100
Blackship BLK 386/40	$1595	$50
Boss 486SX/25 Cache	$3495	none
Compaq Deskpro 4/25si	$3380	none
CompuAdd 425s	$2672	none
Compudyne 486SX/25	$1499	$100
Copam 486SXB/25	$2129	$667
Dell 486D/25	$2719	$408
Eltech Model 3400	$1477	none
Everex Tempo C 486SX/25 Plus	$2796	$430
FastMicro FastData 386/40	$1619	none
Gateway 2000 25MHz 486SX	$1615	$280
Mitac D 4125	$2083	$505
Olivetti M400-10	$2416	$1051
Packard Bell 486SX/25	$2299	none
PC Brand Leader 386/40	$1695	none
PowerBox PBS1-340i	$2145	none
QSI Klonimus 386/40	$1598	$151
Sai 386DX-40	$1675	none
Standard Advantage 386/40	$1935	none
Swan 486SX/25DB	$2645	$10
Tandy 4825 SX	$2223	$896
Tangent Model 340	$1995	none
USA Flex Flex 386/40	$1978	$100

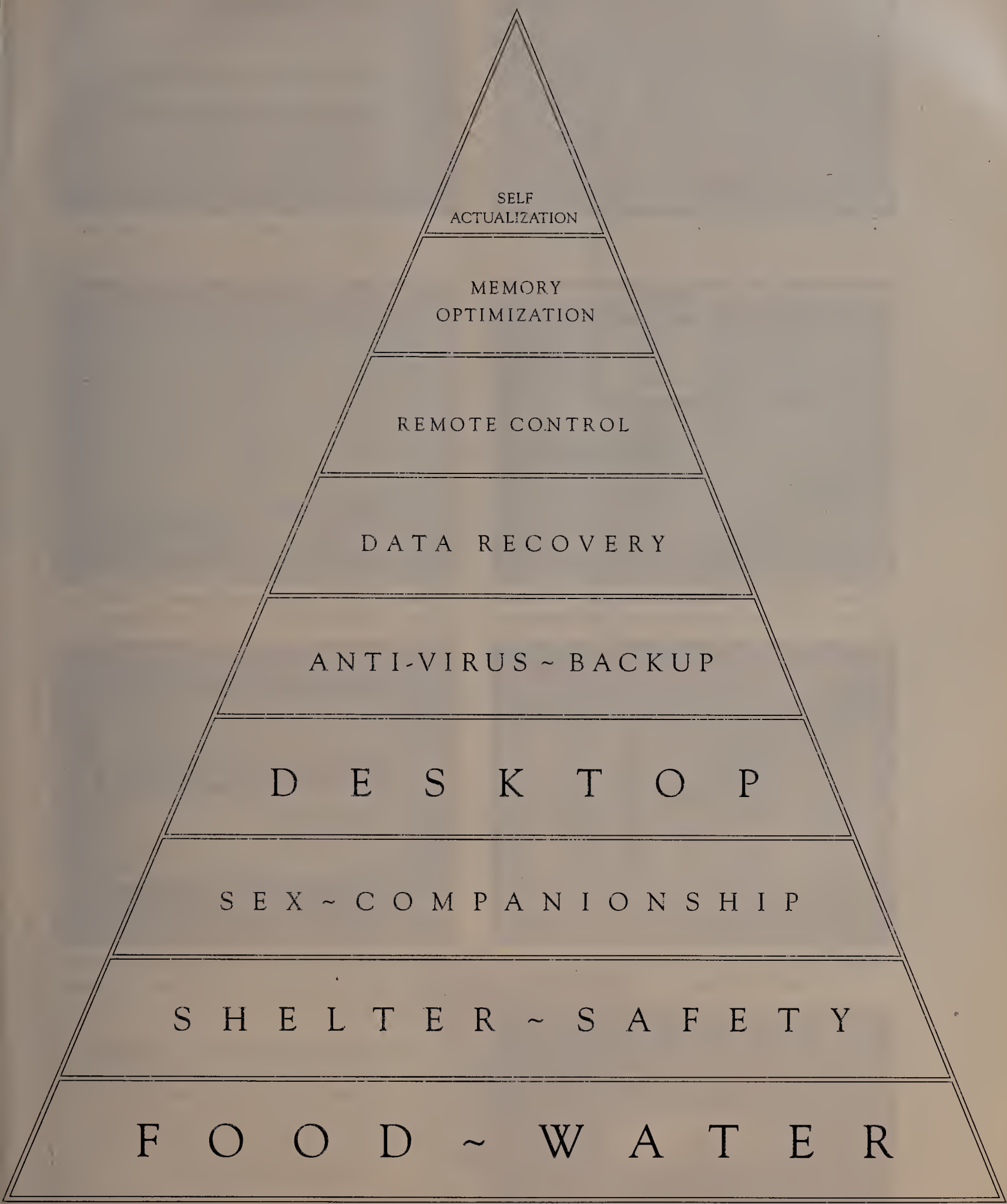
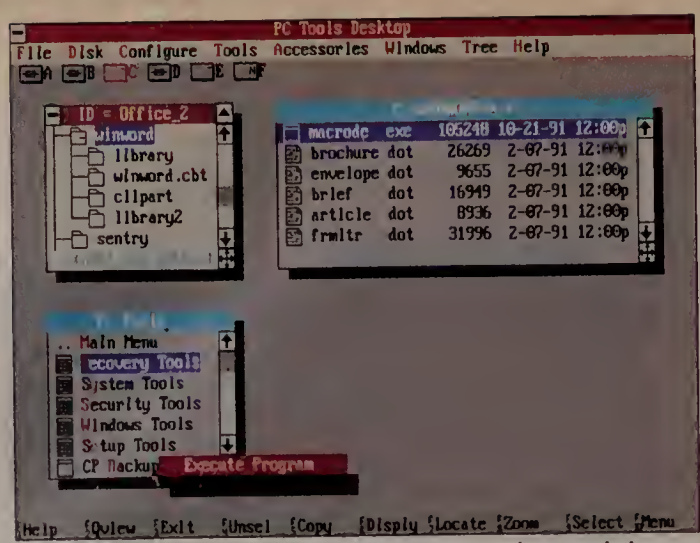
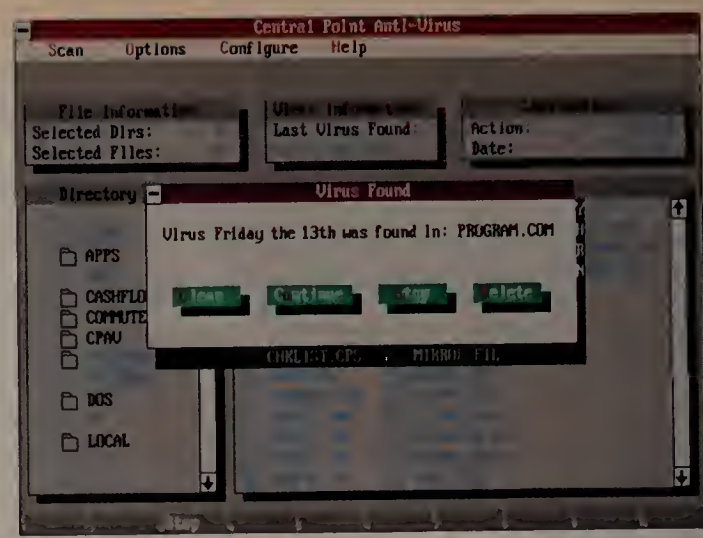


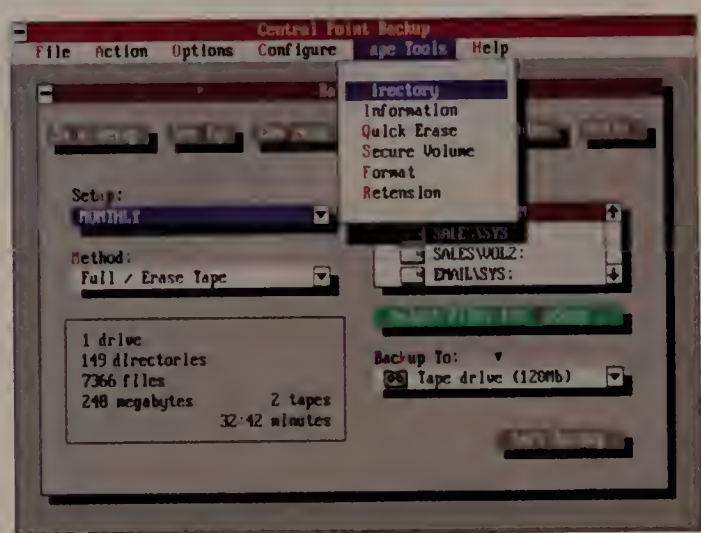
fig. [1]
Maslow's Hierarchy of Needs.



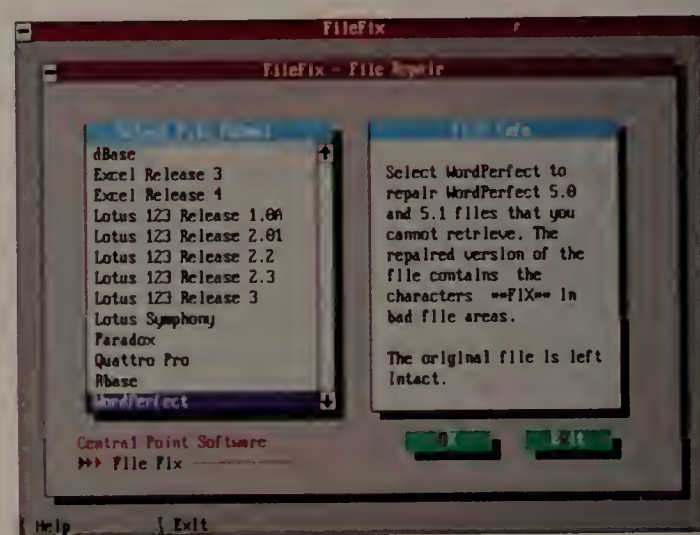
[New] PC Tools™ Desktop gives you a drag-and-drop interface that makes file and program management easy.



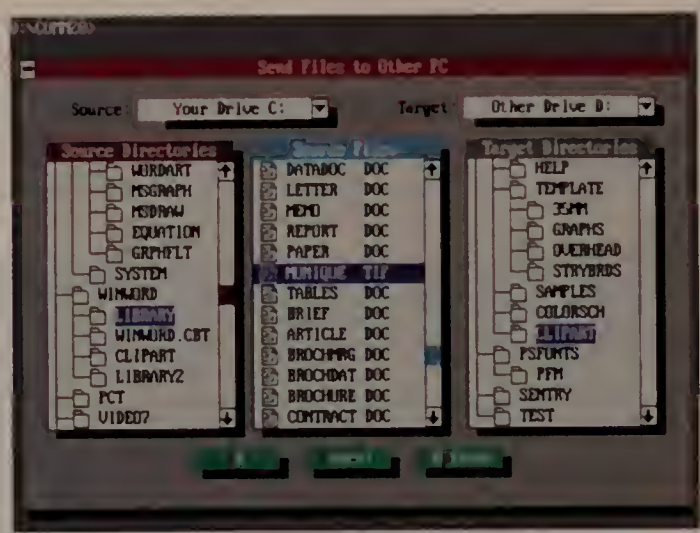
[New] Detect and remove over 1,300 viruses with our complete Central Point® Anti-Virus program.



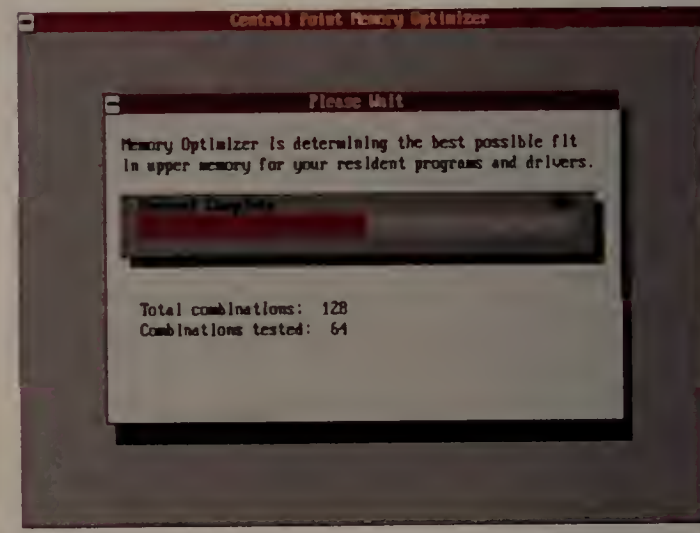
[New] Central Point Backup® now supports SCSI drives and lets you format and erase tapes from inside the program.



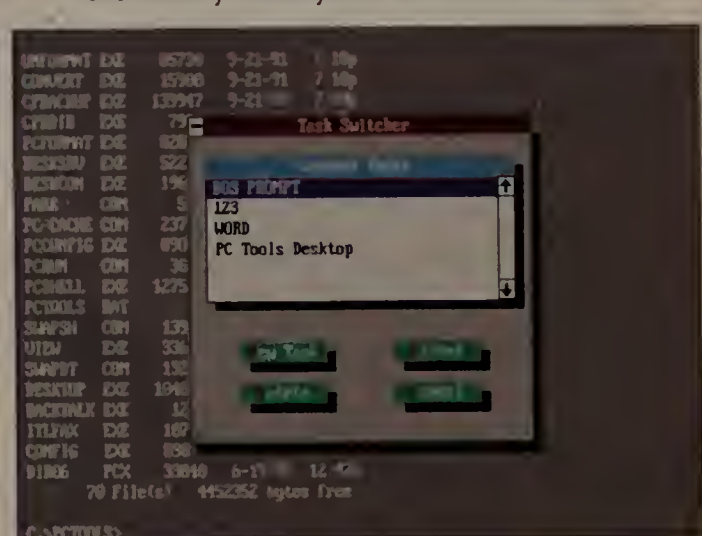
[New] FileFix™ repairs more application files than ever before, including WordPerfect, Excel and Quattro Pro.



[New] Commute® runs faster Windows and DOS sessions and makes file transfers even more convenient.



[New] RAMBoost™ memory optimizer takes full advantage of DOS 5 and frees up more memory for your applications.



[New] Task switching lets you move between multiple DOS applications faster and easier.

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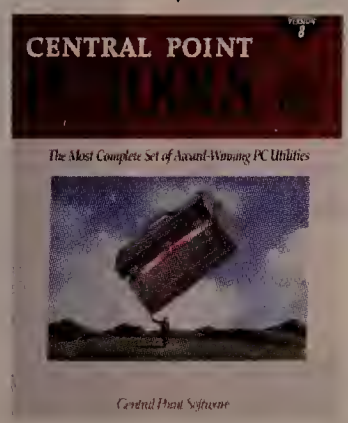
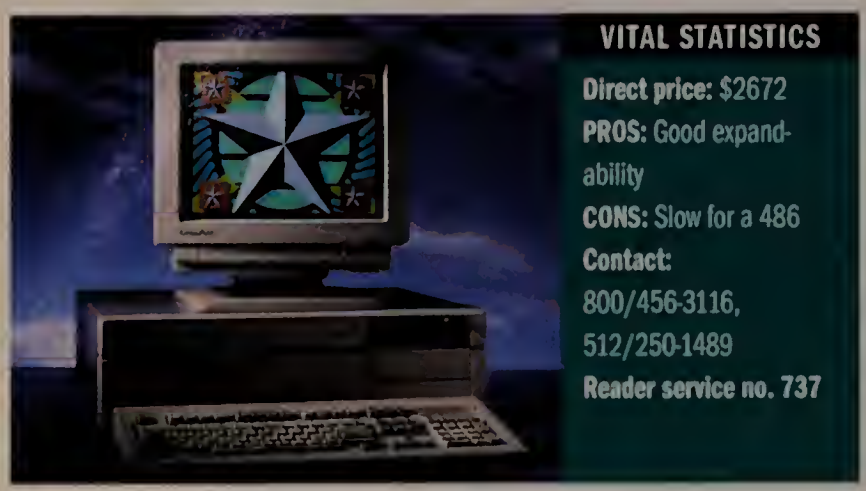


** Food, water, shelter, safety, sex, companionship and self-actualization not included.*

Circle 52 on reader service card

expensive system here (street prices have been falling, though, as Compaq's list price cuts trickle down to dealers). It's also less expandable than some of the other systems here, with just three 8/16-bit slots (all of them open) and only one internal and two externally accessible drive bays.

Despite the cool design, and unless you're willing to pay a premium for the Compaq nameplate, you can find systems that strike a better balance between price and performance.

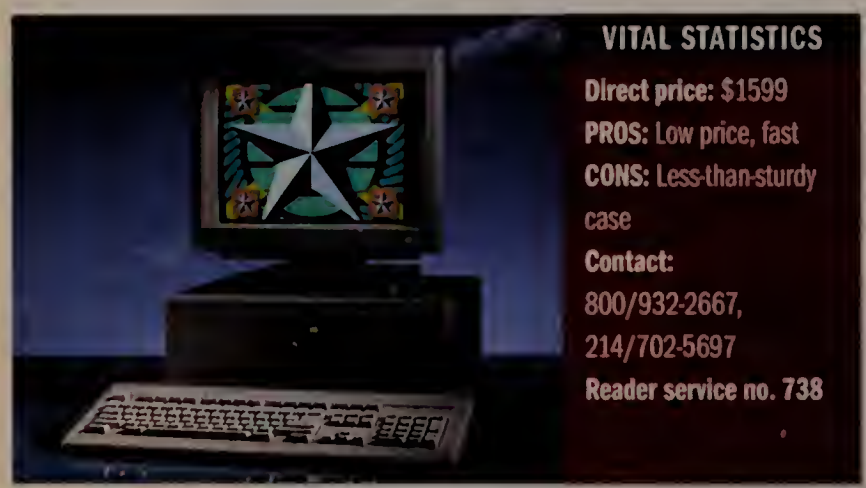


VITAL STATISTICS
Direct price: $2672
PROS: Good expandability
CONS: Slow for a 486
Contact: 800/456-3116, 512/250-1489
Reader service no. 737

CompuAdd 425s

The CompuAdd 425s gives you room for expansion: A space-saving combo floppy drive leaves three of the five 5¼-inch drive bays open (the other bay is occupied by a 203MB Western Digital hard drive), and seven out of eight 8/16-bit slots are available. The system board is cleanly designed, and everything is well mapped in the accompanying documentation.

Too bad this system is so darn slow. Not only is it slower than other 486SXs, it's slower than some 386s costing hundreds less. Lots of systems give you the same amount of room for expansion, and you can find plenty that will give you better value for your money.



VITAL STATISTICS
Direct price: $1599
PROS: Low price, fast
CONS: Less-than-sturdy case
Contact: 800/932-2667, 214/702-5697
Reader service no. 738

Compudyne 486SX/25

The Compudyne 486SX/25 was an easy choice as one of our Best Buys for several reasons. First and foremost was price: At $1599, it's the least expensive 486SX machine in the review and the second least expensive system of any kind here—cheaper than several much slower 386s.

Despite the low price, however, you don't have to give up performance. The Compudyne was competitive with systems costing twice as much, with particularly good times on our *dBASE*, *1-2-3*, and *Windows* benchmarks.

Even though it comes in a compact case, the Compudyne also gives you a surprising amount of expandability, with five of seven 8/16-bit slots free. The only design flaw we could spot: The plastic case doesn't feel as sturdy as some others. Upgrading is easy; you either add an OverDrive chip to the upgrade socket or pull the existing CPU and replace it with a 486DX-33. In the latter case, you have to replace the clock crystal (which should cost you about $10 at your local electronics supplier).

The Compudyne is one system that doesn't make you choose between price and performance—it's one of the few systems here that give you both, making it an easy pick as a Best Buy.

VITAL STATISTICS
Street price: $2748
PROS: None
CONS: Subpar customer service
Contact: 800/828-4200, 510/623-8911
Reader service no. 739

Copam 486SXB/25

The Copam 486SXB/25 features backplane architecture: The lower section of the motherboard holds I/O and video controls. A vertical card with five 8/16-bit slots comes out of this bottom board; you put a card holding the CPU, BIOS, system clock, and memory into one of the slots. To upgrade the processor, you must buy a 486DX-33 board from Copam (for about $900).

Unfortunately, the Copam's performance is only respectable—particularly on *1-2-3* and *WordPerfect*—nothing out of the ordinary for a 486SX. The company's customer support leaves a bit to be desired: On-site service contracts cost 8 percent of the system price, and the quality of the responses to our customer queries was inconsistent. Overall, this is a pretty nondescript system.

VITAL STATISTICS
Direct price: $3128
PROS: Fast, nice design
CONS: High price
Contact: 800/289-3355, 512/338-4400
Reader service no. 740

Dell 486D/25

The Dell 486D/25 was the fourth fastest system we tested. It comes with six free 8/16-bit slots, a nicely laid out motherboard, a 244MB Quantum hard drive, and excellent documentation. So what's not to like? The $3128 price, one of the highest here.

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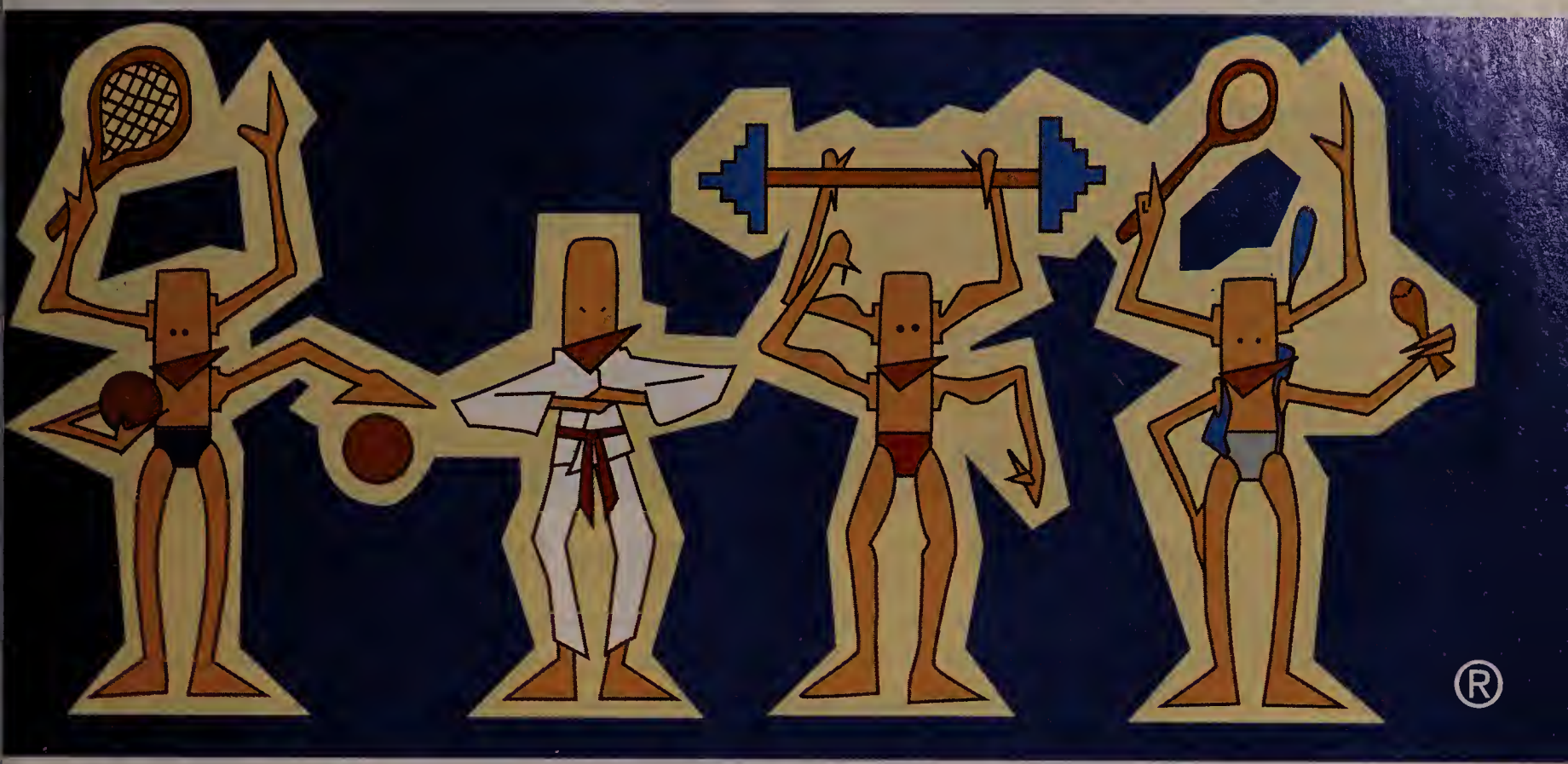

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It should be noted that we were unable to get one of Dell's new low-priced Dimension systems in time to meet our testing schedule; the equivalent 486SX Dimension would have cost about $2000, and if its performance were comparable to that of the system we tested, it would have received a much higher overall rating.

VITAL STATISTICS

Direct price: $1477
PROS: Low price, great service
CONS: Slow
Contact: 800/358-8330, 510/438-0990
Reader service no. 741

Eltech Model 3400

We'll concede one point about the Best Buy Eltech Model 3400: It won't set any speed records. In fact, it came in near the bottom on virtually every one of our benchmarks. However, the spread in overall speed between the fastest and slowest systems here was never *that* great: The Eltech wasn't more than 10 percent below average on any given test and was only 23 percent slower than the fastest system overall. That's why it could do "poorly" on our speed tests and still win a Best Buy.

Two features serve as strong recommendations for this system. First, its $1477 price. This is the cheapest system here—and that low price includes *Microsoft Works for Windows* and *Turbo Menu*. Second, the system is backed by excellent customer support. When we asked the tech staff our typical customer queries, they responded quickly and accurately. Also, the company offers free on-site service for the first six months you own the system.

Our only complaints: Access to some parts of the motherboard, such as the SIMMs and the coprocessor socket, are a bit obscured, making those upgrades trickier than they might otherwise be. Those quibbles aside, if you're willing to make do with slightly subpar performance, the Eltech is an excellent value.

VITAL STATISTICS

Street price: $2741
PROS: None
CONS: Slow for a 486SX, not much room for expansion
Contact: 800/821-0806, 510/498-1111
Reader service no. 742

Everex Tempo C 486SX/25 Plus

The Everex Tempo C 486SX/25 Plus has the dubious honor of being the slowest 486SX here overall. That's still pretty fast compared to most of the 386s but is small consolation. The system's also a bit short on expandability: It gives you just three 8/16-bit slots (all of them free) and three drive bays. Finally, at $2741, this is one of the more expensive systems in the roundup. The combination of high price and low performance makes the Tempo hard to recommend.

VITAL STATISTICS

Direct price: $1619
PROS: Good expansion, cheap
CONS: Slow, poor service-and-support track record
Contact: 800/772-0386
Reader service no. 743

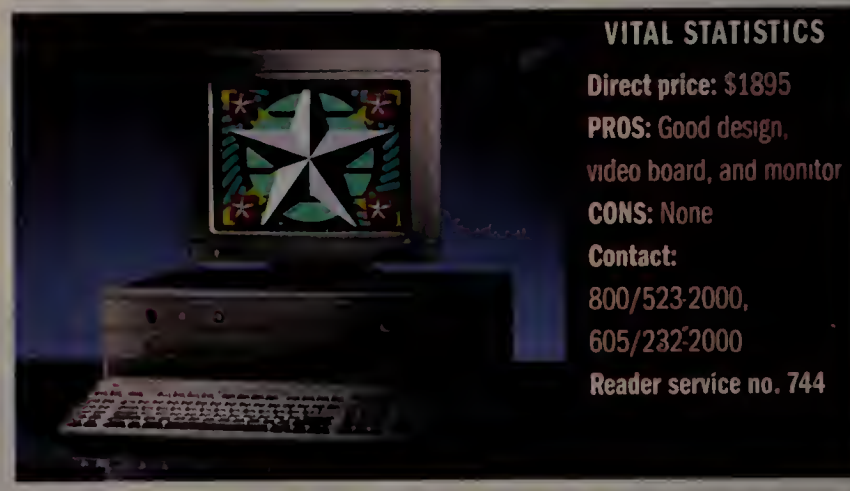
FastMicro FastData 386/40

If you're looking to protect your investment in the future, check out the flexible FastMicro FastData 386/40. It's one of only two upgradable 386s in the review and has a chameleonlike capability to change processor type and clock speed from a 386DX-25 all the way to a 486DX-50.

But you do pay a price for this system—not in dollars (at $1619, it's the third cheapest here), but in peace of mind. A recent *PC World* study as well as many letters from readers indicate there are problems within FastMicro's service-and-support organization. So we are for the moment forced to rate FastMicro's support as poor.

If the service and support had been adequate, this system would have been a Best Buy, despite its poor speed—overall it was 20 percent slower than the fastest system here. The substantial 170MB hard drive is useful and especially noteworthy considering the system's overall low price. The machine's dual cooling fans are especially useful if you upgrade with the fast but very hot OverDrive chip.

If you aren't worried about FastMicro's service-and-support policies or are convinced the company will have cleaned up its act by the time you buy, and you're looking to upgrade later, then this would make an excellent, cheap system.

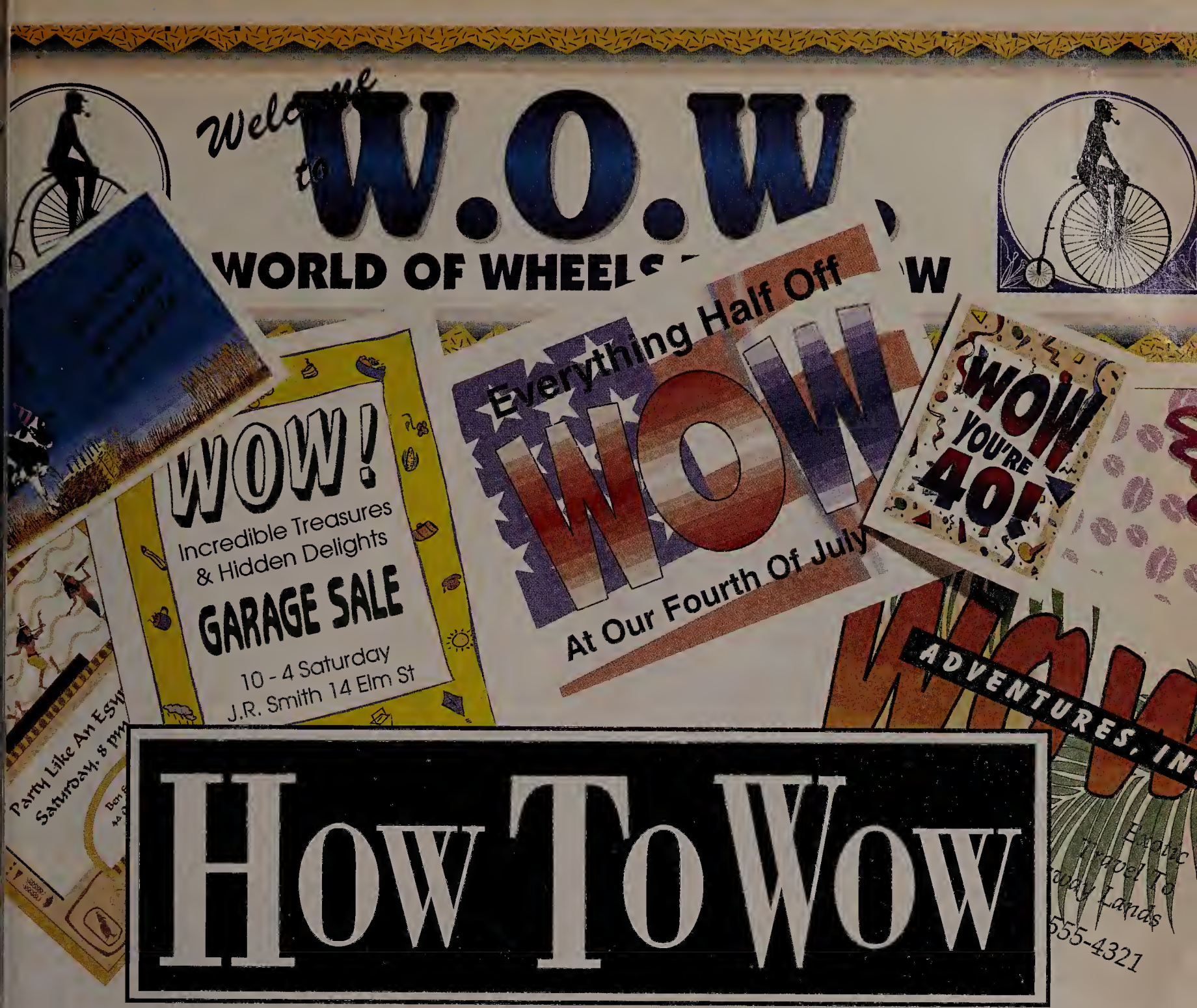


VITAL STATISTICS

Direct price: $1895
PROS: Good design, video board, and monitor
CONS: None
Contact: 800/523-2000, 605/232-2000
Reader service no. 744

Gateway 2000 25MHz 486SX

The silver-gray Gateway 2000 25MHz 486SX looks great. It has a sleek design with a gently bowed front panel on its sturdy, full-size



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desktop case. Unfortunately, this design doesn't translate into great performance. The system was the 13th fastest in the roundup, about 10 percent slower than the fastest machine.

Its price is also unexceptional: $1895 is good compared with the other 486SXs' prices, but average compared with the 386s' (the price does include your choice of Microsoft application software).

A great ATI Graphics Ultra video board and sharp Gateway monitor deliver fast, crisp graphics. If you want a good-looking system that'll serve you well, particularly after you pop in an OverDrive chip to boost performance, consider the Gateway.

VITAL STATISTICS

Street price: $2042
PROS: Large hard drive
CONS: One of the slowest 486SXs
Contact: 800/777-1688, 510/623-5300
Reader service no. 745

Mitac D 4125

This compact 486SX-25 uses a sturdy, straightforward design. It comes with a 202MB hard drive, better than average for the systems in the roundup. Allowing for this, its street price of $2042 makes it one of the cheaper 486SXs here.

The Mitac D 4125 is the second slowest of the 486SXs we reviewed, 13 percent slower than the fastest system overall. Despite no real problems, however, little stood out about this system.

VITAL STATISTICS

Direct price: $3637
PROS: Great design
CONS: Expensive, slow for a 486SX
Contact: 800/633-9909, 509/927-5600
Reader service no. 746

Olivetti M400-10

Italian design certainly made its mark on the attractive Olivetti M400-10. The case is beautifully designed, very compact, and light but sturdy. Inside, system components are tightly laid out.

Unfortunately, the Italian design comes with a price tag to match those on the racks of the top Milan fashion houses. At $3637, this is easily the most expensive system in the review. Performance is also lackluster for a 486SX.

If you buy only from the top design houses, or if you really need 52MB of RAM on board, take a look at this system; otherwise, stick to something with a department-store price tag.

VITAL STATISTICS

Street price: $1698
PROS: Cheap, fast, large hard drive
CONS: Only one free drive bay
Contact: 800/488-2905, 818/886-1111
Reader service no. 747

Packard Bell 486SX/25

This compact desktop from Packard Bell hides some real performance behind its ordinary exterior. It was the sixth fastest system overall on our tests and came in fourth on the *Paradox* test. Inside the box lurks a monster 239MB hard drive—enough to swallow up your storage problems for some time.

The Packard Bell 486SX/25 was also the second cheapest 486SX and the seventh cheapest system overall.

One flaw is that there's only one free drive bay for future storage enhancements such as tape backup or an internal CD ROM. The CPU upgrade path is via a clock doubling OverDrive chip.

The combination of low price and high performance netted the Packard Bell a Best Buy; consider it seriously, especially if you think you might need to boost performance later with an OverDrive chip.

VITAL STATISTICS

Direct price: $1695
PROS: Very fast 1-2-3 performance, cheap
CONS: Slow on everything else
Contact: 800/722-7263, 805/378-7801 (fax)
Reader service no. 748

PC Brand Leader 386/40

The PC Brand Leader 386/40 seems ordinary enough at first glance, but take a look at its score on our *1-2-3* test. It managed a first-place finish, 28 percent faster than any other system, despite being one of the slowest systems in the review on all the other tests. A look under the hood revealed the reason—the system comes standard with a Cyrix 87DLC-40 math coprocessor. The result is an eighth-place finish overall on our performance tests.

The PC Brand uses a modular, upgradable design, unusual in a 386 system. The CPU, coprocessor, and cache reside on a board held inside a metal case that plugs into the front of the system, much like a giant Nintendo cartridge. In this case, the board holds the AMD 386-40, the Cyrix coprocessor, and 32K of external processor cache.

The rest of the system is standardized on a normal motherboard. There was only one free drive bay on our system, despite the use of a

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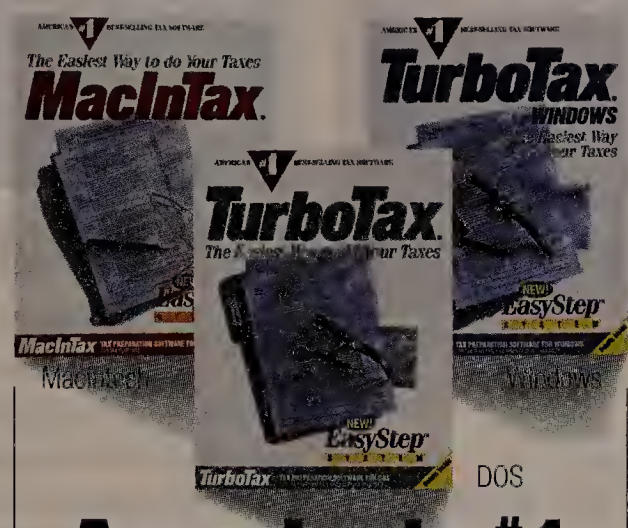

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combo floppy drive to fit a 3½-inch and 5¼-inch drive into a single drive bay. The second bay is occupied by a 120MB Seagate drive.

At $1695, the PC Brand is the sixth cheapest system in our review. This status, combined with the machine's overall eighth-place finish on performance, makes it an attractive buy. However, remember that except for on the *1-2-3* test, its performance was poor. Our recommendation? Buy this system if you're looking for a hot coprocessor-enhanced system at a low price.

VITAL STATISTICS
Direct price: $2145
PROS: Several free drive bays, two-year warranty
CONS: Pricey
Contact: 800/899-8269, 818/999-9653
Reader service no. 749

PowerBox PBS1-340i

This minitower system is pretty heavy and sturdy. It's one of the faster 386 systems we tested, and it tied for ninth place overall on the *Windows* test.

The PowerBox PBS1-340i leaves three drive bays free, plenty of room for adding more hard drives or other storage peripherals, such as tape backup or a CD ROM drive. Unfortunately, the relatively high $2145 price means there is little to make this machine shine. A two-year warranty is better than average, but we'd still advise you to look at one of the other systems here.

VITAL STATISTICS
Direct price: $1749
PROS: Good all-around design
CONS: Slow
Contact: 800/347-5500, 718/834-4545
Reader service no. 750

QSI Klonimus 386/40

The QSI Klonimus 386/40 has few obvious advantages, but a balanced mix of a $1749 price, good service and support, and decent expandability makes this system a Best Buy.

The motherboard on the QSI Klonimus is tightly designed (and, in fact, is the same motherboard as that used in the Sai system). The combination of a faster hard drive and quicker video gave the QSI the edge over the Sai on our performance tests.

The QSI comes with a 64K external cache, expandable to 256K; a 125MB hard drive; four free 8/16-bit slots; and three free drive bays. All of these are normal features for the machines in this review—so how did the QSI rate so well? The answer is integration. QSI did a better job of fitting all the parts together to make a complete system, and capped it with a good price.

Buyers interested in a 386 with good all-around performance and a decent price should consider this system carefully.

VITAL STATISTICS
Direct price: $1675
PROS: Three-year warranty, cheap, good keyboard
CONS: Very slow
Contact: 800/331-0488, 203/929-0790
Reader service no. 751

Sai 386DX-40

At $1675, the Sai 386DX-40 is the fifth cheapest system in the review. It uses the same motherboard as the QSI Klonimus but manages to get inferior performance because of a slower hard disk and video. In fact, the Sai is the slowest system in the roundup, turning in bottom-rung scores on our *1-2-3* and *Paradox* tests.

The Sai gets bonus points for a very nice keyboard with a hinged cover that protects it from dust and doubles as a paper stand. But the schizophrenic design also has a terribly small recessed reset switch on the front of the system.

The Sai offers an amazing three-year warranty—well above average for most PCs, so if you feel the need for some extra, long-term support, take a look at this system. The Sai is also worth considering because of its price, but since it turned in the slowest performance scores in the whole review, it's hard to recommend this machine wholeheartedly.

VITAL STATISTICS
Direct price: $1935
PROS: Good all around, two-year warranty
CONS: Hard to upgrade
Contact: 800/662-6111, 818/337-7711
Reader service no. 752

Standard Advantage 386/40

The Standard Advantage 386/40 just missed being a Best Buy, finishing sixth. Its performance was mediocre—19 percent slower than the fastest system overall. In addition, it's hard to upgrade the system's RAM since it's placed under the power supply.

At $1935, the cost of the Standard is pretty average for a 386 too. However, you do get copies of *1-2-3*, *Norton Desktop for Windows*, and *Norton AntiVirus* bundled for free with the system. You also get

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There are better 386s in the review, but the Standard is a balanced system that compares relatively well as a whole.

VITAL STATISTICS
Direct price: $2655
PROS: Very upgradable, two-year warranty
CONS: Expensive
Contact: 800/468-9044, 814/238-1820
Reader service no. 753

Swan 486SX/25DB

This tough 486SX compact desktop has a good motherboard design. It uses a modular, replaceable CPU board and can be upgraded all the way to a 486DX-50. It delivered middling performance results for a 486SX—it was 10 percent slower than our fastest system overall. The system includes on-board local-bus video, so its relatively ordinary performance on our *Windows* test is surprising, suggesting that Swan has yet to optimize the video for the faster bus.

Swan throws in a valuable software bundle for home or small-business use—*Microsoft Works for Windows*, *Quicken for Windows*, and *Wealth Builder*.

The large 212MB hard drive helps explain some of the hefty $2655 price tag, but not all. Despite excellent expansion options and a two-year warranty, this system doesn't stand out.

VITAL STATISTICS
Street price: $2978
PROS: Nice design
CONS: Very expensive
Contact: 817/390-3011
Reader service no. 754

Tandy 4825 SX

The Tandy 4825 SX is nicely put together and is particularly light. The clever design lets you unfold the drive units and power supply from above the motherboard for easy access once you remove the outer case.

The bad news about the design is that its compactness hasn't left room for any free drive bays. The three drive bays are taken up by the 3½-inch and 5¼-inch floppy drives and a 119MB hard drive. More bad news is the price—$2978 is one of the highest prices in our review, and ordinary performance doesn't help this system shine. The inclusion of *Microsoft Works* is a nice touch but doesn't make enough of a difference. You should look for a cheaper system.

VITAL STATISTICS
Direct price: $1995
PROS: Good service and support
CONS: Poor expandability
Contact: Contact a local Radio Shack store or dealer
Reader service no. 755

Tangent Model 340

Tangent provides some of the best service we've found. The company provides virtually every service option we check for, and the responses to customer queries are sharp.

Too bad the Tangent Model 340 is a straightforward 386. It has no upgrade options apart from a coprocessor socket—which is hard to reach. Not only that, but several of the expansion slots are obstructed by drive bays and SIMMs, making expansion difficult.

The Tangent was one of the faster 386s but, at $1995, also one of the more expensive. Despite the great service, there are plenty of better systems to consider in this review.

VITAL STATISTICS
Direct price: $2078
PROS: Good service and support
CONS: Limited CPU upgrade
Contact: 800/876-5603, 708/351-9700
Reader service no. 756

USA Flex Flex 386/40

This ordinary-looking system turned out to be fast for a 386, though it was still 15 percent slower than the fastest 486SX here overall. It did well consistently on most tests, coming in 11 percent to 13 percent behind the leader time after time. Some of the credit for the machine's speed goes to a hefty 256K external processor cache.

The USA Flex Flex 386/40 got good ratings for service and support, finishing at the top of that category. Among other nice options, the company offers 24-hour customer service. As a result of this top-notch service, it ended up in seventh place overall, just outside our Best Buys. The $2078 price is a bit high, but for that you get (relatively) good performance and the excellent service (as well as a copy of *PFS:WindowWorks*). The USA Flex lets you expand RAM to 64MB using a dedicated memory board. Three free drive bays add some room for growth, but the only CPU upgrade option is to add an Intel coprocessor.

Overall, the USA Flex is worth a look, especially if you want a straightforward machine that's well supported.

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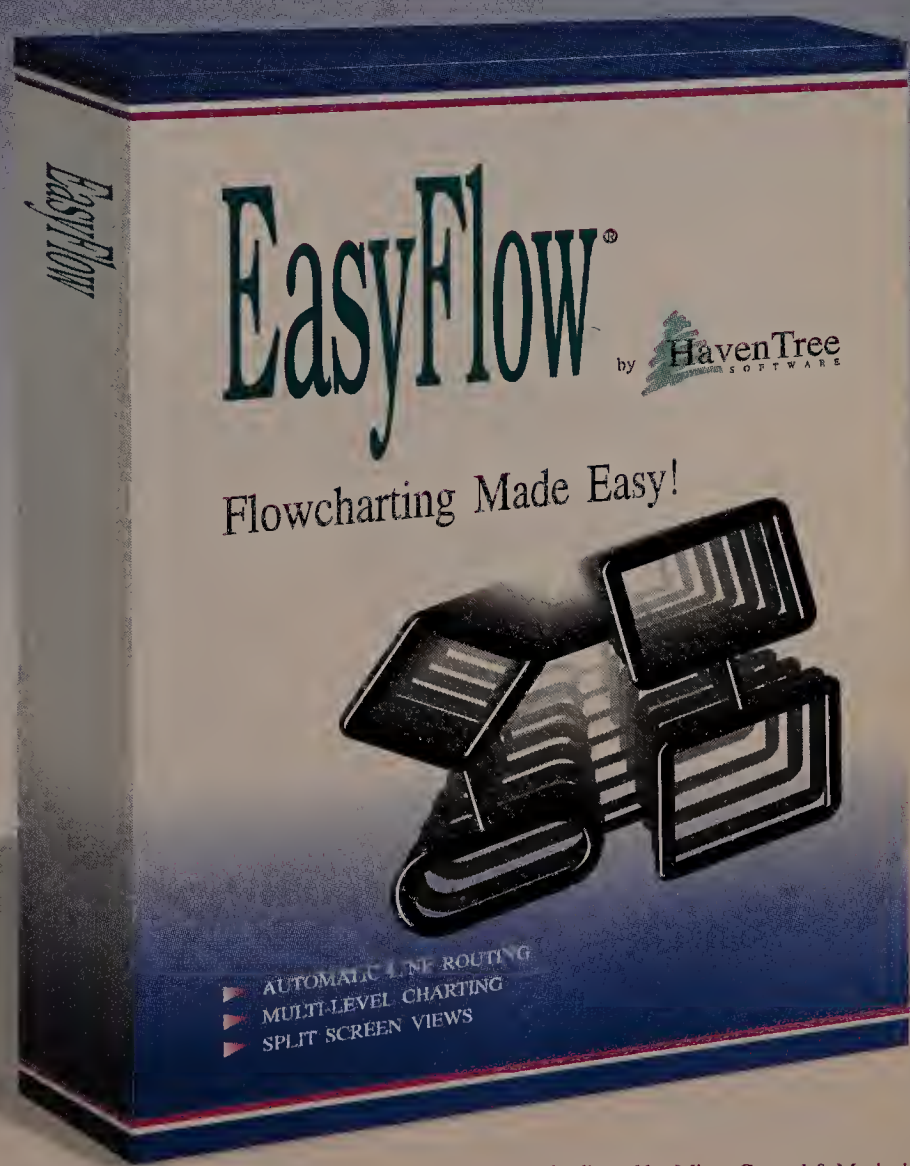

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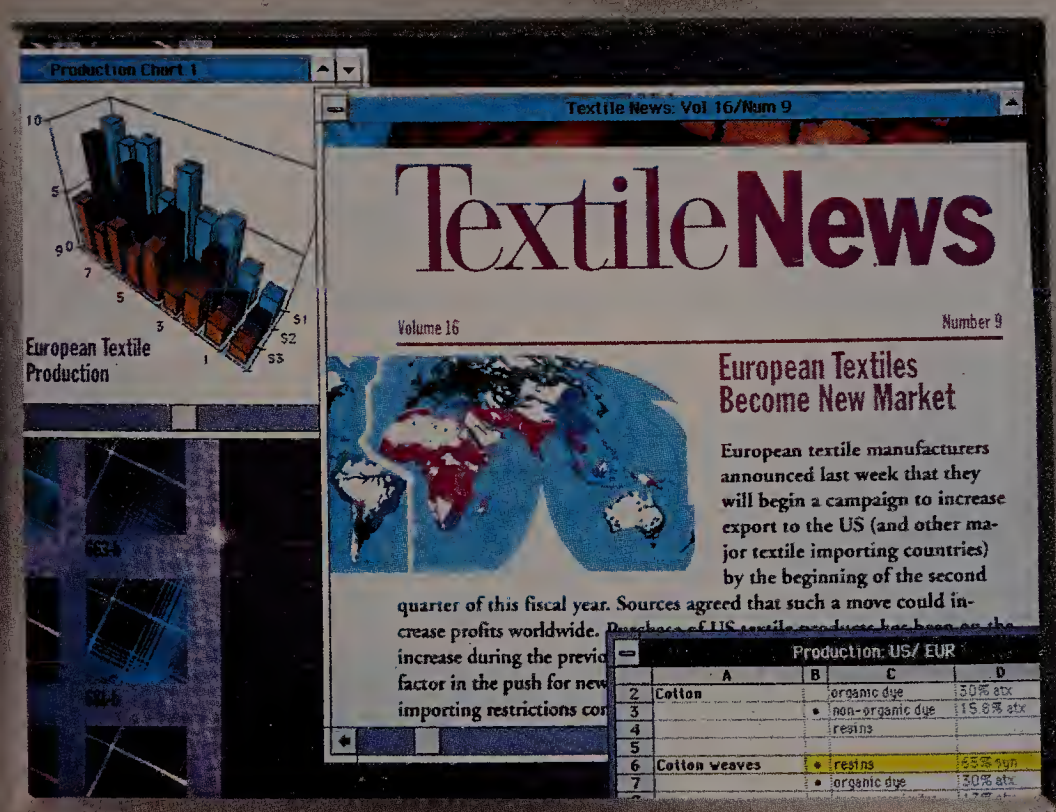

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FEATURES COMPARISON

486SX-25s and 386-40s: Equipped for the Business Mainstream

● Yes
○ No
n/a = not applicable

	Acma 386-40	ALR Flyer 32DT 4SX/25	Amax 386-40 ISAmax Power Station	Arche Legacy 386/40	AST Power Premium 4/25s	Aura 386/40
Standard features						
Street/direct price [1]	$2245	$2977	$1868	$3260	$3452	$2046
Bus	ISA	ISA	ISA	ISA	EISA	ISA
CPU	386DX-40	486SX-25	386DX-40	386DX-40	486SX-25	386DX-40
BIOS	AMI	Phoenix	AMI	AMI	AST	AMI
Chip set	SIS	UMC	SIS	Arche	AST/Intel	UMC
Power supply (watts)	200	145	250	200	145	230
Hard disk	Seagate ST3283A	Maxtor 7213AT	Seagate ST3144A	Western Digital Caviar 2200	Quantum ProDrive LPS	Seagate ST3120A
Size (MB)/type	239/IDE	212/IDE	124.5/IDE	203/IDE	234/IDE	120/IDE
Floppy drives: 1.2MB/1.44MB/combo	1/1/0	1/1/0	1/1/0	1/1/0	1/1/0	1/1/0
Ports: parallel/serial/mouse/other	1/2/0/game	1/2/1/0	1/2/0/game	1/2/0/0	1/2/1/0	1/2/0/game
Case	minitower	compact	compact	desktop	compact	tower
Graphics board/Integrated chip	Diamond Stealth VRAM	Integrated WD90C30	Orchid Fahrenheit 1280	Diamond SpeedStar VGA	Integrated WD90C31	VGA 1024
Accelerator	●	●	●	○	●	○
Expandability						
CPU upgrade path	none	replaceable processor card	none	none	replaceable processor card	none
Accepts clock doublers	○	●	○	○	●	○
Accepts Weitek coprocessor	●	○	●	●	○	●
Adjustable clock	○	○	○	○	○	●
Free/total 32-bit slots	0/0	1/2 [4]	0/0	1/1 [5]	2/3 [4]	0/0
Free/total 16-bit slots	3/6	4/4	3/6	4/6	5/6	5/8
Free/total 8-bit slots	2/2	0/0	2/2	1/1	0/0	0/0
Externally accessible 5¼-inch/3½-inch bays	4/0	1/1	3/1	2/0	3/0	5/2
Internal 5¼-inch/3½-inch bays	1/0	0/1	0/0	1/1	0/2	1/2
Maximum fast RAM on motherboard/system (MB)	32/32	36/36	32/64	32/32	16/80	32/32
External cache/maximum external cache (K)	64/64	256/256	64/256	128/128	0/0	64/256
Cache type	direct-mapped write-back	direct-mapped write-back	direct-mapped write-back	direct-mapped write-back	n/a	direct-mapped write-back
Service and support						
Warranty (months)	12	12	12	24	12	12
On-site service price/term	free/1 year	varies/1 year	$69/1 year	free/2 years	varies/1 year	$99/1 year
Turnaround policy (days)	none	3	7	2	7	2
Free unlimited support from vendor	●	●	●	●	●	n/a
Toll-free tech support	●	●	●	○	●	n/a
Daily support (hours)	11	10	11	10	14	n/a
Weekend support	●	●	●	○	●	n/a
BBS	●	●	●	●	●	n/a
Fax	●	●	●	●	●	n/a
Dedicated support staff required for dealers	n/a	○	●	n/a	○	●
Dealer support staff training required	n/a	○	○	n/a	○	○
Dedicated support line for dealers	n/a	●	●	n/a	●	●
Parts inventory required of dealers	n/a	●	●	n/a	○	○

[1] Except as noted, standard system configuration includes 8MB RAM, hard drive, SVGA, color monitor, serial and parallel ports, keyboard, mouse, Windows 3.1, and DOS 5.0.

[2] Includes Artisoft's Lantastic.

[3] Includes Microsoft Works for Windows and Turbo Menu.

Bell BSP 1340	BEST BUY Blackship BLK 386/40	Boss 486SX/25 Cache	Compaq Deskpro 4/25sl	CompuAdd 425s	BEST BUY Compudyne 486SX/25	Copam 486SXB/25	Dell 486D/25	BEST BUY Eltech Model 3400
$1999	$1645	$3333	$3251	$2672	$1599[2]	$2748	$3128	$1477[3]
ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA
386DX-40	386DX-40	486SX-25	486SX-25	486SX 25	486SX-25	486SX-25	486SX-25	386DX-40
AMI	AMI	AMI	Compaq	Phoenix	AMI	Phoenix	Phoenix	AMI
OPTi	OPTi	C&T	Compaq	C&T	UMC	UMC	VLSI	Symphony
250	250	300	145	200	200	160	224	200
Conner CP30104	Maxtor 7120AT	Seagate ST3283A	Conner CP32010	Western Digital Caviar 2200	Maxtor 7120AT	Seagate ST1239A	Quantum 240AT	Maxtor 7120AT
121/IDE	119/IDE	239/IDE	210/IDE	203/IDE	119/IDE	201/IDE	244/IDE	119/IDE
1/1/0	1/1/0	1/1/0	1/1/0	0/0/1	1/1/0	1/1/0	1/1/0	1/1/0
1/2/0/0	1/2/0/game	1/2/0/0	1/1/1/audio	1/2/0/0	1/2/0/game	1/2/0/0	1/2/1/0	1/2/0/game
minitower	desktop	minitower	compact	desktop	compact	compact	compact	compact
Hicolor Turbo FX	Orchid ProDesigner IIs	Genoa Multimedia Model 7900	Compaq QVision	CompuAdd Windows Accelerator	PVGA	Trident TVGA	integrated WD90C31	Trident TVGA
○	○	○	●	●	●	○	●	○
none	none	upgrade socket	replaceable CPU	upgrade socket	upgrade socket	replaceable processor card	replaceable CPU	none
○	○	●	●	●	●	●	●	○
●	●	○	○	●	○	●	○	●
●	○	●	●	●	●	○	●	●
0/0	1/1[5]	0/0	0/0	0/0	1/1[6]	0/0	0/0	0/0
3/5	6/7	6/7	3/3	7/8	5/7	4/5	6/6	5/7
2/2	0/0	1/1	0/0	0/0	1/1	0/0	0/0	0/1
3/1	2/2	3/2	1/1	3/0	3/0	3/0	3/0	3/2
1/1	0/3	0/1	0/1	2/0	0/2	0/1	0/2	0/0
32/64	32/64	32/32	32/32	32/32	32/32	16/16	64/64	32/32
64/256	64/256	64/256	64/64	64/256	256/256	128/256	0/0	64/256
direct-mapped write-back	direct-mapped write-back	direct-mapped write-back	two-way set assoc. write-back	direct-mapped write-back	direct-mapped write-back	direct-mapped write-back	n/a	direct-mapped write-back
12	12	24	12	12	12	12	12	12
$100/1 year	free/1 year	free/2 years	free/1 year	free/1 year	free, 1 year	$220[7]/1 year	free/1 year	$69/1 year[8]
3	2	2	none	3	2	3	none	2
○	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
8	9	10	12	24	13	11.5	18	9
○	○	○	○	●	●	○	●	●
○	○	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
○	n/a	○	●	●	●	○	n/a	n/a
○	n/a	○	●	●	●	○	n/a	n/a
○	n/a	○	●	●	●	○	n/a	n/a
○	n/a	○	○	●	●	○	n/a	n/a

[4] Proprietary slots, one occupied by CPU board.
[5] Dedicated 32-bit memory slot.
[6] Proprietary local-bus slot.
[7] 8 percent of system price.
[8] First six months free, second six months $69.

Table continues on following pages

FEATURES COMPARISON

486SX-25s and 386-40s *continued*

● Yes
○ No
n/a = not applicable

	Everex Tempo C 486SX/25 Plus	FastMicro FastData 386/40	Gateway 2000 25MHz 486SX	Mitac D 4125	Olivetti M400-10	BEST BUY Packard Bell 486SX/25
Standard features						
Street/direct price[1]	$2741	$1619	$1895[2]	$2042	$3637	$1698
Bus	ISA	ISA	ISA	ISA	ISA	ISA
CPU	486SX-25	386DX-40	486SX-25	486SX-25	486SX-25	486SX-25
BIOS	AMI	AMI	Phoenix	AMI	Olivetti	Phoenix
Chip set	Everex	Symphony	C&T	Contaq	Olivetti	OPTi
Power supply (watts)	145	200	200	200	150	145
Hard disk	Seagate ST1239A	Conner CP30174E	Western Digital Caviar 2120	Conner CP3204F	Conner CP30126	Seagate ST3283A
Size (MB)/type	201/IDE	170/IDE	119/IDE	202/IDE	116/IDE	239/IDE
Floppy drives: 1.2MB/1.44MB/combo	0/1/0	1/1/0	1/1/0	1/0/0	0/1/0	1/1/0
Ports: parallel/serial/mouse/other	1/2/0/0	1/2/0/game	1/2/0/game	1/2/0/game	1/1/1/0	1/1/1/game
Case	compact	desktop	desktop	compact	compact	compact
Graphics board/integrated chip	Integrated Tseng ET 4000	Paradise Accelerator Card for Windows	ATI Graphics Ultra	AcuMos SVGA	Integrated VGA Plus	Integrated Oak VGA
Accelerator	○	●	●	○	○	○
Expandability						
CPU upgrade path	replaceable processor card	replaceable CPU	replaceable CPU	upgrade socket	upgrade socket	upgrade socket
Accepts clock doublers	●	●	●	●	●	●
Accepts Weitek coprocessor	○	○	○	●	●	○
Adjustable clock	○	●	○	○	●	○
Free/total 32-bit slots	0/0	0/0	0/0	0/0	0/0	0/0
Free/total 16-bit slots	3/3	6/8	4/6	6/8	4/4	4/4
Free/total 8-bit slots	0/0	0/0	2/2	0/0	0/0	0/0
Externally accessible 5¼-inch/3½-inch bays	0/2	3/2	5/0	3/1	1/1	2/1
Internal 5¼-inch/3½-inch bays	0/1	1/1	0/0	0/1	0/2	0/1
Maximum fast RAM on motherboard/system (MB)	32/32	32/32	32/64	32/32	52/52	20/20
External cache/maximum external cache (K)	128/128	64/128	0/0	64/512	0/0	64/256
Cache type	direct-mapped write-back	direct-mapped write-through	n/a	direct-mapped write-back	n/a	direct-mapped write-back
Service and support						
Warranty (months)	12	12	12	12	12	12
On-site service price/term	free/1 year	free/1 year	free/1 year	$99/1 year	varies/1 year	free/1 year
Turnaround policy (days)	3	2	none	7	7	none
Free unlimited support from vendor	●	●	●	●	●	●
Toll-free tech support	○	●	●	●	●	●
Daily support (hours)	12	10	18	10	24	24
Weekend support	○	●	●	○	●	●
BBS	●	●	●	●	○	●
Fax	●	○	●	●	●	●
Dedicated support staff required for dealers	●	n/a	n/a	○	n/a	○
Dealer support staff training required	●	n/a	n/a	○	n/a	○
Dedicated support line for dealers	●	n/a	n/a	○	n/a	○
Parts inventory required of dealers	○	n/a	n/a	○	n/a	○

[1] Except as noted, standard system configuration includes 8MB RAM, hard drive, SVGA, color monitor, serial and parallel ports, keyboard, mouse, Windows 3.1, and DOS 5.0.

[2] Includes your choice of Microsoft application software.

[3] Includes 1-2-3, Norton Desktop for Windows, and Norton AntiVirus.

PC Brand Leader 386/40	PowerBox PBS1-340i	BEST BUY QSI Klonimus 386/40	Sai 386DX-40	Standard Advantage 386/40	Swan 486SX/25DB	Tandy 4825 SX	Tangent Model 340	USA Flex Flex 386/40
$1695	$2145	$1749	$1675	$1935[4]	$2655[4]	$2978[5]	$1995	$2078[6]
ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA
386DX-40	386DX-40	386-40	386-40	386-40	486SX-25	486SX-25	386DX-40	386DX-40
PC Brand	AMI	AMI	AMI	AMI	AMI	Phoenix	AMI	AMI
WDC	VSLI	PC Chip	PC Chip	Symphony	VLSI	VLSI	SiS	OPTI
130	250	200	200	200	200	1600	200	200
Seagate ST3120A	Maxtor 7120AT	Seagate ST3144A	Conner CP30104H	Maxtor 7130AT	Maxtor 7213AT	Western Digital Caviar 2120	Maxtor 7120AT	Western Digital Caviar 2200
120/IDE	119/IDE	124.5/IDE	121/IDE	119/IDE	212/IDE	119/IDE	119/IDE	203/IDE
0/0/1	1/1/0	1/1/0	1/1/0	1/1/0	0/0/1	1/1/0	1/1/0	1/1/0
1/2/0/0	1/2/1/0	1/2/0/game	1/2/0/game	1/2/1/game	1/2/0/0	1/2/1/0	1/2/0/game	1/2/0/game
desktop	minitower	compact	minitower	compact	compact	compact	compact	compact
integrated WD90C31	ATI VGA Wonder XL	AVGA Super 16	Diamond SpeedStar VGA	ATI Graphics Ultra	integrated S3	integrated WD90C31	Diamond SpeedStar 24X	Diamond Stealth VRAM
●	○	○	○	●	●	●	●	●
replaceable processor card	none	none	none	none	replaceable processor card	replaceable CPU	none	none
○	○	○	○	○	●	●	○	○
○	●	●	●	●	●	○	●	○
○	○	○	○	●	●	●	○	○
0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
6/6	7/8	4/6	4/6	6/8	5/6	3/3	4/6	6/7
1/1	0/0	2/2	2/2	0/0	0/0	0/0	2/2	0/0
3/0	4/0	3/1	5/0	2/1	3/0	1/2	3/2	3/2
0/0	2/0	0/2	0/1	0/1	0/1	0/0	0/0	0/1
16/16	32/32	32/32	32/32	32/32	64/64	32/32	32/32	32/64
32/64	64/256	64/256	64/256	64/256	128/128	0/0	64/64	256/256
direct-mapped write-through	direct-mapped write-back	direct-mapped write-back	direct-mapped write-through	direct-mapped write-back	direct-mapped write-back	n/a	direct-mapped write-through	direct-mapped write-back
12	24	24	36	24	24	12	12	12
free/1 year	free/1 year	free/1 year	n/a	free/1 years	free/2 years	$179.50/1 year	free/1 year	free/1 year
3	none	none	3	none	none	2	3	2
●	●	●	●	●	●	●	●	●
●	●	●	○	●	●	○	●	●
12.5	11	8	9	9	12	11	8.5	24
●	●	○	●	●	●	○	○	●
●	○	●	○	●	●	●	●	○
●	○	●	●	●	●	●	●	●
n/a	n/a	n/a	n/a	n/a	n/a	○	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	○	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	●	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	○	n/a	n/a

[4] Includes Microsoft Works for Windows, Wealth Builder, and Quicken for Windows.

[5] Includes Microsoft Works.

[6] Includes PFS:WindowWorks.

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TEST REPORT

486SX-25s Come Out on Top

	1-2-3 2.2	Windows 3.0	WordPerfect 5.1	dBASE IV 1.1	Paradox 3.5
Boss 486SX/25 Cache	460	78	42	321	[illegible]
AST Power Premium 4/25s	458	79	42	[illegible]	[illegible]
ALR Flyer 32DT 4SX/25	458	76	44	[illegible]	[illegible]*
Dell 486D/25	467	82	43	[illegible]	[illegible]
Compaq Deskpro 4/25sl	460	83	44	[illegible]	[illegible]
Packard Bell 486SX/25*	470	85	44	[illegible]	[illegible]
Compudyne 486SX/25*	462	81	47	[illegible]	[illegible]
PC Brand Leader 386/40	331	[illegible]	57	[illegible]	[illegible]
Acma 386-40	518	79	46	[illegible]	[illegible]
Arche Legacy 386/40	511	79	48	[illegible]	[illegible]
Swan 486SX/25DB	470	87	45	[illegible]	[illegible]
Copam 486SXB/25	467	87	45	[illegible]	[illegible]
Gateway 2000 25MHz 486SX	473	87	46	[illegible]	[illegible]
CompuAdd 425s	471	[illegible]	47	[illegible]	[illegible]
Tandy 4825 SX	474	[illegible]	46	[illegible]	[illegible]
Olivetti M400-10	470	87	47	[illegible]	[illegible]
Mitac D 4125	470	93	46	[illegible]	[illegible]
Everex Tempo C 486SX/25 Plus	467	[illegible]	51	[illegible]	[illegible]
USA Flex Flex 386/40	544	[illegible]	49	[illegible]	[illegible]
Tangent Model 340	520	[illegible]	51	[illegible]	[illegible]
PowerBox PBS1-340I	526	84	51	[illegible]	[illegible]
Standard Advantage 386/40	550	84	51	[illegible]	[illegible]
FastMicro FastData 386/40	525	96	51	[illegible]	[illegible]
QSI Klonimus 386/40*	539	87	52	[illegible]	[illegible]
Amax 386-40 ISAmax Power Station	524	96	53	[illegible]	[illegible]
Blackship BLK 386/40*	548	89	52	[illegible]	[illegible]
Eltech Model 3400*	547	91	53	[illegible]	[illegible]
Bell BSP 1340	542	95	54	[illegible]	[illegible]
Auva 386/40	569	95	56	[illegible]	[illegible]
Sal 386DX-40	587	100	54	[illegible]	[illegible]

*Best Buy

Systems are arranged in order of overall speed, from fastest at top to slowest at bottom.

Time in seconds.

Methodology All computers tested with 8MB RAM using the vendor's version of DOS 5.0. Hard disk sizes ranged from 119MB to 244MB.

1-2-3 2.2 We load the application, followed by three separate worksheets (arithmetic, financial, and scientific). We make changes and run recalcs on each. Finally, we use the *MAPS* add-in from Management Advisory Services of Seattle to run a number of financial forecasts.

Windows 3.0 Timing begins and ends at the DOS prompt. We launch *Windows* along with a macro that loads *Microsoft Excel* with a worksheet and initiates a recalc. Then the macro loads Lotus's *Ami Pro* along with a 50K document that contains a 500K TIFF image. Finally, the macro launches *Micrografx Designer*, opens a drawing, displays it on screen, and exits to DOS.

WordPerfect 5.1 We reformat three *WordPerfect 5.1* documents that vary in size from 5K to 55K. The files contain some boldface and underlining; one document includes a TIFF file.

dBASE IV 1.1 With caching enabled, we complete an unindexed search for a single record in a 100,000-record table. Then we index the table, run the transaction processing module, and post 600 records.

Paradox 3.5 Starting with an orders table, we compare each record with an available stock table. The application finds the current price for the items and inserts the result into an invoice table.

Data based on tests designed and conducted by the PC World Test Center. All rights reserved.

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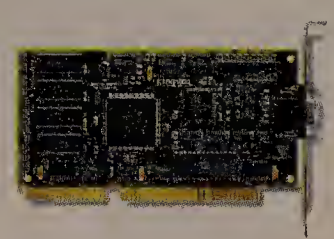

Microsoft Excel spreadsheet tested on 386SX-20 PC. All Trademarks and Registered Trademarks are of their respective holders. Kingston and Kingston Technology are Registered Trademarks of Kingston Technology Corporation.

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TEST REPORT

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Dell 486D/25	467	82	43	[illegible]	[illegible]
Compaq Deskpro 4/25sl	460	83	44	[illegible]	[illegible]
Packard Bell 486SX/25*	470	85	44	[illegible]	[illegible]
Compudyne 486SX/25*	462	81	47	[illegible]	[illegible]
PC Brand Leader 386/40	331	[illegible]	57	[illegible]	[illegible]
Acma 386-40	518	79	46	[illegible]	[illegible]
Arche Legacy 386/40	511	79	48	[illegible]	[illegible]
Swan 486SX/25DB	470	87	45	[illegible]	[illegible]
Copam 486SXB/25	467	87	45	[illegible]	[illegible]
Gateway 2000 25MHz 486SX	473	87	46	[illegible]	[illegible]
CompuAdd 425s	471	88	47	[illegible]	[illegible]
Tandy 4825 SX	474	[illegible]	46	[illegible]	[illegible]
Olivetti M400-10	470	[illegible]	47	[illegible]	[illegible]
Mitac D 4125	470	93	46	[illegible]	[illegible]
Everex Tempo C 486SX/25 Plus	467	90	51	[illegible]	[illegible]
USA Flex Flex 386/40	544	85	49	[illegible]	[illegible]
Tangent Model 340	520	[illegible]	51	[illegible]	[illegible]
PowerBox PBS1-340I	526	84	51	[illegible]	[illegible]
Standard Advantage 386/40	550	[illegible]	51	[illegible]	[illegible]
FastMicro FastData 386/40	525	96	51	[illegible]	[illegible]
QSI Klonimus 386/40*	539	87	52	[illegible]	[illegible]
Amax 386-40 ISAmax Power Station	524	96	53	[illegible]	[illegible]
Blackship BLK 386/40*	548	89	52	[illegible]	[illegible]
Eltech Model 3400*	547	91	53	[illegible]	[illegible]
Bell BSP 1340	542	[illegible]	54	[illegible]	[illegible]
Auva 386/40	[illegible]	95	56	[illegible]	[illegible]
Sal 386DX-40	587	[illegible]	54	[illegible]	[illegible]

*Best Buy

Systems are arranged in order of overall speed, from fastest at top to slowest at bottom.

Time in seconds.

Methodology All computers tested with 8MB RAM using the vendor's version of DOS 5.0. Hard disk sizes ranged from 119MB to 244MB.

1-2-3 2.2 We load the application, followed by three separate worksheets (arithmetic, financial, and scientific). We make changes and run recalcs on each. Finally, we use the *MAPS* add-in from Management Advisory Services of Seattle to run a number of financial forecasts.

Windows 3.0 Timing begins and ends at the DOS prompt. We launch *Windows* along with a macro that loads *Microsoft Excel* with a worksheet and initiates a recalc. Then the macro loads Lotus's *Ami Pro* along with a 50K document that contains a 500K TIFF image. Finally, the macro launches *Micrografx Designer*, opens a drawing, displays it on screen, and exits to DOS.

WordPerfect 5.1 We reformat three *WordPerfect 5.1* documents that vary in size from 5K to 55K. The files contain some boldface and underlining; one document includes a TIFF file.

dBASE IV 1.1 With caching enabled, we complete an unindexed search for a single record in a 100,000-record table. Then we index the table, run the transaction processing module, and post 600 records.

Paradox 3.5 Starting with an orders table, we compare each record with an available stock table. The application finds the current price for the items and inserts the result into an invoice table.

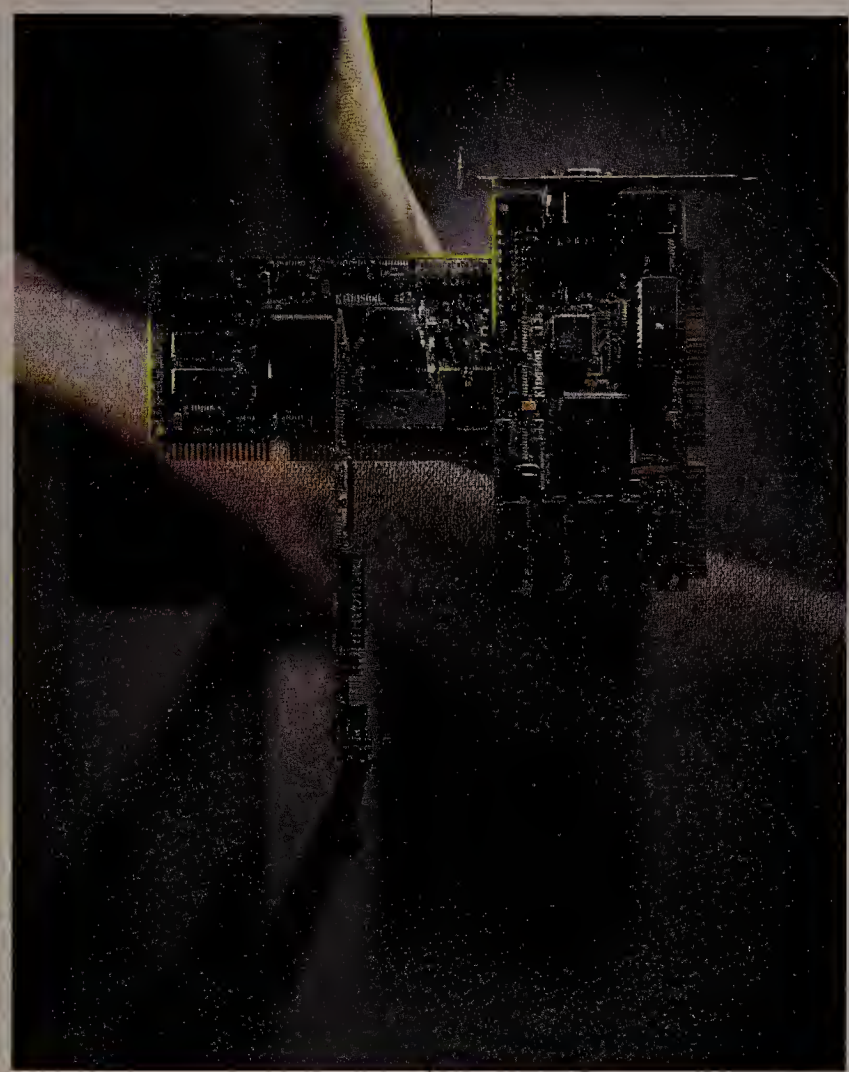
Data based on tests designed and conducted by the PC World Test Center. All rights reserved.

NOW YOU CAN AFFORD TO BUY SOME TIME.

At $149, any budget can afford ViewRx, the Windows Business Application Accelerator.

Kingston knows that staring at an hourglass isn't the best use of your time. We know that people who run Windows spreadsheets and word processors don't like to wait for text scrolls, reformats, cuts and pastes. We know that your time is valuable.

But we also know that budgets are tight; and when faced with the choice of just muddling along with slow business applications or spending hundreds of dollars on a Windows accelerator, you may reluctantly choose to just muddle along.



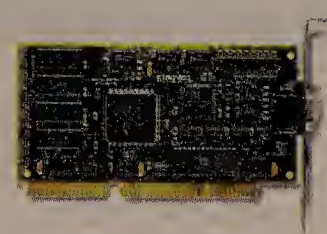
The affordable Windows Accelerator.

That's why we created ViewRx, the cure for slow running Windows business applications. Windows spreadsheet tests show that ViewRx makes your applications run three times faster.

ViewRx is based on the Weitek 5186 chip that has Windows BitBLT and line draw functions built in. That means that these often used Windows functions are handled by ViewRx, not by the CPU. And that means better performance for you. ViewRx supports up to 1024 x 768 screen resolution to fit even the largest spreadsheets on the screen. For the least possible screen flicker, ViewRx offers a 72Hz refresh rate and supports non-interlaced mode. ViewRx comes complete with trouble free drivers for Windows 3.1 and popular CAD packages.

Kingston Reliability.

Every ViewRx is thoroughly tested and warranted for five years. You can always count on Kingston's free technical support if you have even the slightest problem. For more information on the remedy for slow Windows or a reseller near you, call Kingston at (800) 835-6575.



Microsoft Excel spreadsheet tested on 386SX-20 PC. All Trademarks and Registered Trademarks are of their respective holders. Kingston and Kingston Technology are Registered Trademarks of Kingston Technology Corporation.

Kingston TECHNOLOGY CORPORATION

THE INSIDE NAME IN UPGRADES

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Yes! You Can Set Up Your Own Databases

Simpler Than dBase & Paradox, More Powerful Than Q&A!

REVIEWER'S NOTEBOOK: *Alpha FOUR has been a runaway best-seller since its introduction, allowing anyone to fully automate and computerize invoices, inventory systems, sales prospecting systems, customer lists and more. The reason is simple: Alpha FOUR requires NO programming. In just a few hours, you can create professional databases, customized to fit your needs.*

Alpha FOUR is the only database we've found that can be used right out of the box, without the tedious training time needed for the others. It runs from DOS, so you know it runs on any computer — lightning fast. But that's only the beginning...

The new Version 2.0 is packed with all the latest advanced features like network capability and 5 times the speed of the previous award-winning version. You really can do it yourself with this fantastic database and application development system!

That Monday morning I was ecstatic with anticipation. I work for a real estate office in FL. Just the night before I put the finishing touches on my new application, and it was time to call in the boss and my three realty agents to unveil my new creation. It was beautiful. A major step in handling our number one problem: disorganization causing us to lose prospects and valuable time.

At first they were skeptical. You see, I've tried other programs with them before, none of which were very impressive. But this time I was confident. I knew I had something to knock their socks off. They saw the colorful, easy-to-follow menus I had created. Their enthusiasm grew as they realized this could really help them. At the end, their applause was overwhelming as they congratulated me on my stroke of genius. (Of course, I didn't tell them how easy it was with Alpha FOUR.)

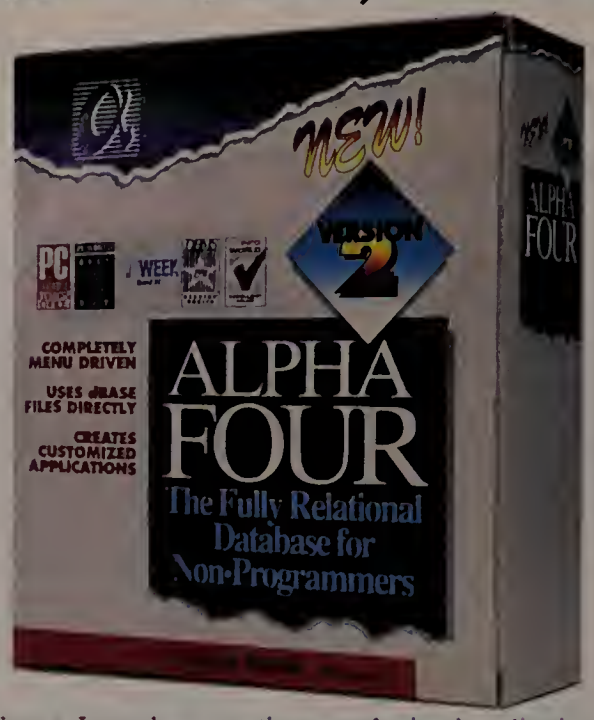
With Alpha FOUR I can create custom applications in a fraction of the time I spend with other programs. It's the fastest, easiest database program I've ever seen.

Here at Sunshine Realty we work hard to get new prospects. We're good at it. But our rate of turning prospects into customers was below average. We always had trouble keeping track of them and following up at the right time. I had to do something to stop this waste of valuable leads. So I decided to computerize.

A programmer friend of mine told me to buy dBase and create a database. So I did. Or at least I tried. It was a bomb. After a full week of trying to figure it out, I still couldn't create a simple menu for my new application. I just didn't know what to do. And the huge manuals were no help. Finally, I gave up.

I tried buying off-the-shelf Contact Management software packages, but they were no good. They all seemed to have a trillion things I didn't need which just cluttered up the screen. My agents wouldn't even attempt to use them because they looked like more work than they were worth.

Then I read about this new database for non-programmers like me: Alpha FOUR. It has all the power of dBase, but without any programming experience needed. So I gave it a try. Wow! Was I amazed! Within



hours, I was busy creating a professional application that does exactly what I need it to do.

My Prospect Tracking application has beautiful screens that were incredibly easy to make. Using Alpha FOUR's Screen Painter, I simply drew a picture of what I wanted. Fields for the prospect's name, phone, lead source, follow-up date, even a memo field that's like a mini word processor for notes is all there. A colorful border and helpful instructions right on-screen tell my agents what to do. It's all so easy. I don't have to tell them anything. They merely follow along and reap the benefits of our own fully-customized, automated system.

I Set Up My Own Database In Minutes.

First, I needed a system of menus and sub-menus. Was I ever surprised to see how easy that was! With Alpha FOUR's "Application Editor" I wrote an outline of my menus and sub-menus. Alpha FOUR automatically created my multi-level menus right from there. Changing my menus was just as easy.

Forms and Reports.

Alpha FOUR's Report Writer was even more impressive. I "painted" reports on-screen. They looked exactly like I wanted them to — much better than our old paper forms. This "What You See Is What You Get" approach to report writing gives me the flexibility I need to create meaningful and detailed reports.

Totally dBASE Compatible.

I was delighted to hear Alpha FOUR is totally compatible with dBASE .dbf files. Our mailing list went right into the new application without even having to be converted! And when my Alpha FOUR application grows, it'll import those Lotus 1-2-3 files used over in accounting. In fact, Alpha FOUR can import and export Lotus 1-2-3, Symphony, VisiCalc, PFS, MultiMate, WordPerfect.

*Talk about ease-of-use combined with **power** — I can relate 3 database files together for my Invoicing application. Alpha FOUR gives me what I need for serious applications.*

And Now I Get Fancy...

I breezed through the tutorial just to get a fully operational application, but now I have the time to dress up. First, I'll change my menus to 3D boxes for the selections and change some of the colors. Alpha FOUR makes it all so easy. Then I'll customize some of the data entry screens so they look just like the paper forms the employees are used to.

With menu-driven ease, I create applications with Alpha FOUR that before I never thought possible. I don't need to be a programmer — I need to know what I want to create. Alpha FOUR takes care of the rest.

Version 2 takes ease-of-use to a new level by allowing more productivity with less work. **Plus one of the great new features is network support.** Fully Novell and NetBios compatible (including LANtastic, MainLan, LANManager, Banyan and others), Alpha FOUR Version 2 allows you to actually create networkable applications by filling in one simple screen. All file and record locking procedures are handled for you — automatically. And although many database products are networkable, only Alpha FOUR Version 2 makes it so simple.

Awarded for Version 1.1 — *PC Week*, May 14, 1990; *InfoWorld*, May 22, 1989; *PC Magazine*, December 17, 1991; *DBMS*, December 1991; *PC World*, March 1990.

Awarded for Version 2.0 — *PC Computing*, June and August 1992; *Home Office Computing*, September 1992.

PC/COMPUTING Best Value · PC WEEK Rated #1 · ★★★½ Home Office Computing September 1992 · PC Magazine Editors' Choice · PC World Best Buy · The PC/Computing 200 Best PC Products · DBMS Readers' Choice · PC World Excellent Value

FREE With Alpha FOUR: FORMFILLER 4.0

The PC is a perfect tool to help you fill in forms and quietly FormFiller has become the world's best-selling, most used form fill-in software. In fact, more people, in more types of business, rely on FormFiller to fill-in their preprinted forms than all competitors combined!

HERE'S WHAT YOU GET:

Alpha FOUR (Single User) ..... reg. price $495.0
FormFiller 4.0 ..... reg. price $149.0
Zip Code Database ..... reg. price $49.9

Total Value **$644.9**

ALL FOR JUST $99.90

ASK ABOUT
THE ALPHA FOUR SERVER UNI
You Get TWO Extra Network LAN Packs Inside Absolutely FREE! *($1049 Value).*

Alpha FOUR Version 2

COMPETITIVE UPGRADE

BCW3450-3 **Alpha FOUR Version 2 Non-Networkable** 3½" **$99.90**
BCW3450-5 **Alpha FOUR Version 2 Non-Networkable** 5¼" **$99.90**

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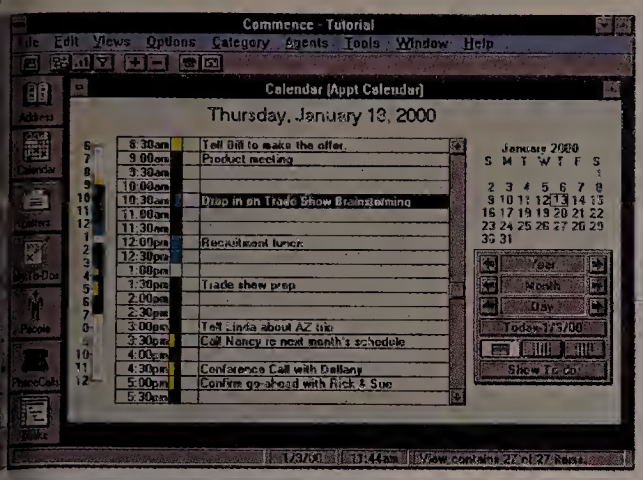
The Information Manager That Doesn't Need You.



Everything about the Commence screen is clear, intuitive and fast, including the command bar that provides push-button access to frequently used functions.

REVIEWER'S NOTEBOOK: *If you're currently using any other Personal Information Manager, you probably can't imagine how ANY PIM can handle things automatically...*

But Commence is no ordinary Personal Information Manager. It was developed by Jensen-Jones, the driving force behind IBM's Current. Now, they've pioneered a new Information Management concept that organizes and prioritizes your tasks, meetings, business contacts and schedules in a way no one ever thought of before. The secret? Give Commence the ability to customize itself to the user. You just make a few menu selections and Commence arranges things the way you want them.

Commence features a breakthrough known as "agent technology." They're like macros that went to college. Very smart — able to automate entire tasks — not just one step. Besides Commence's amazing ability to become perfectly tailored to the user, these Agents are the hottest things we've seen in years — Commence thinks for itself.

Agents perform little miracles like printing out all your appointments and meetings for the day (complete with details) — exactly at 8:55 a.m. so it's on your desk when you arrive. Or ask Commence to compile and print a To-Do list of all outstanding tasks, projects and other details -- on the evening before you travel. Automatically fax a flower or food basket order to your florist for any customer who places an order of $5000 or more (great idea!). Automatically add any "urgent" or "handle immediately" messages to your high priority To-Do list.

COMMENCE

BCW3666 **Commence** **$239.00**

The World's Best Diskettes and Tapes.

REVIEWER'S NOTEBOOK: *We wanted the highest quality, most durable, longest lasting, best diskettes and tapes for our TigerSoftware catalog. So we shopped, and compared, and tested... until we came to a unanimous conclusion: Fuji is Number 1. Their 30 years of excellence in the recording products industry has led them to the forefront of computer media technology.*

Their extensive research and development has culminated in unique patents and designs that no one else has. Their dedication to the future has resulted in new recording media products years ahead of the competition.

Here at Tiger we believe that storage and backup media has to be the best. Second rate just won't do. When it comes to priceless data that's irreplaceable, who could consider otherwise? That's why we'll only sell the best, and the best is Fuji.

If You're Not Sure Which To Get, Just Call!

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5.25" DISKETTES

BCW7364 **MD2HD** 10 Pack **$8.00**
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BCW7358 **DC-6150 ¼"** **$26.00**
BCW7359 **DC 2000 ¼"** **$17.00**
BCW7360 **DC 2120 ¼"** **$23.00**
BCW7361 **DC 300XLP ¼"** **$22.00**
BCW7362 **DC 2080 ¼"** **$19.00**

Transfer Files From Laptop To Desktop @ 3MB Per Minute!

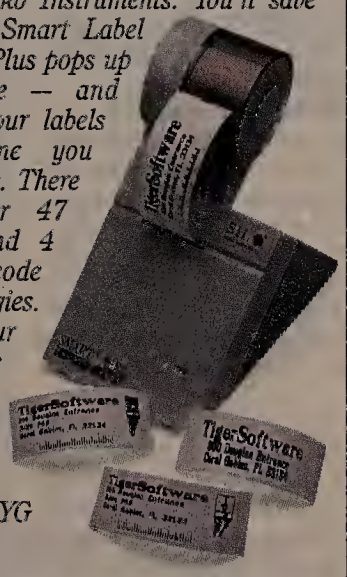
REVIEWER'S NOTEBOOK: *Every laptop user knows the vital necessity of being able to get files to and from a desktop — fast. When it's time to run and the plane is waiting, you want something that's easy to use, lets you quickly find exactly what you need, and gets the needed files from your desktop to your laptop in a hurry. And nobody does it better than the all-time leader: LapLink Pro. Better yet, let the new LapLink Pro 4.0 use its "Synchronize" feature to make two directories identical, transferring only the required files. And if for some reason you still left a file behind, LapLink Pro works just as well over the phone as it does with its direct cables.*

LAPLINK PRO

BCW3524 **LapLink Pro 4.0** . **$109.95**
BCW3525 **LapLink Pro 4.0 Upgrade** **$59.95**
BCW3526 **LapLink Pro 10 Pak** **$599.95**

SMART LABELS!

REVIEWER'S NOTEBOOK: *Includes printer and software that combine to print your labels with lightning speed. Print one or one hundred! Desktop printers can't match the precision and flexibility of Smart Label Printer Plus from Seiko Instruments. You'll save time — Smart Label Printer Plus pops up anywhere — and prints your labels any time you need one. There are over 47 fonts and 4 bar code symbologies. See your labels on-screen, with Smart WYSIWYG display.*



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BCW6995 **Smart Label Printer Plus Windows & Dos** . . **$199.95**
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BCW6998A **Clear Labels** (2 Rolls–130 Each) . . **$14.99**
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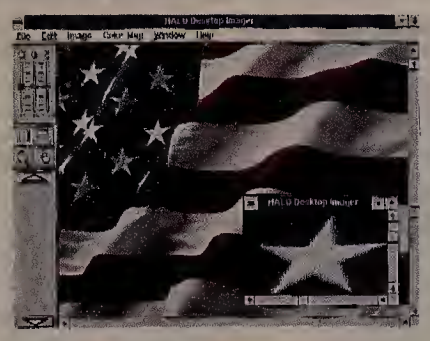
BCW6997 **Smart Label Printer Plus Windows Software Upgrade** **$49.95**

NEW! Desktop Imager Version 2.0



REVIEWER'S NOTEBOOK: *Tiger is proud to present the all-new Desktop Imager — with expanded retouching and color separation capabilities. Faster, easier to use and more powerful — it's a must for design and pre-press work.*

With its amazing wealth of abilities to capture Windows screens, convert between different file formats, print spectacular multi-page output, apply special effects and more, HALO Desktop Imager is the #1 Windows imaging tool anyone working with images simply must own.

HALO Desktop Imager is the #1 solution for images in all your desktop publishing needs.

NEW DESKTOP IMAGER v2.0

BCW3129-3 **Desktop Imager 2.0** 3½" **$99.90**
BCW3129-5 **Desktop Imager 2.0** 5¼" **$99.90**

Requires 512K and hard disk.

The Incredible $49.95 Dr. Halo Upgrade

Create, Capture, Paint, Correct, Manipulate And Convert Images!

Open the box and get ready for a slew of easy-to-use features, like large-image support, sophisticated palette support (up to 256 colors on any display), gradient fills that produce the smoothest shaded objects and background we've seen, support for all popular SuperVGA boards, incredible new printing capabilities for top-notch halftones and enhanced font support for great looking type.

DR. HALO UPGRADE

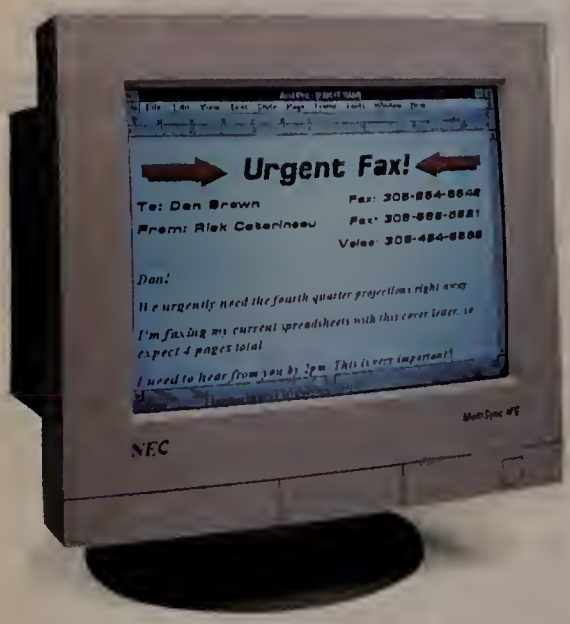
BCW3262-3 **Dr. Halo Competitive Upgrade** **$49.95**
BCW3262-5 **Dr. Halo Competitive Upgrade** **$49.95**

Requires 512K and hard disk.

Circle 214 on reader service card

Turn Your PC Into A Fax Machine!

REVIEWER'S NOTEBOOK: *Your PC is the perfect fax machine: it easily creates documents to fax, it has powerful printing capabilities and contains plenty of storage space. It allows you to automatically transmit faxes at a certain time. You can send crisp, clean facsimile documents right from your desktop or laptop PC. The advantages of a PC fax machine are virtually unlimited. All you need to do is plug in one of these top-quality fax modems. Whether you prefer DOS or Windows, whether you want an internal board or an external model, whether you need the latest screaming-fast data modem or the standard 2400 bps data*



modem built into every Frecom product — we have a winner that's right for you.

Tiger offers you fax modems from the award-winning leader in the industry: Frecom. Frecom practically started the fax modem craze with their legendary Fax96. Their years of experience and research have resulted in the finest fax and data modems to be found anywhere. And Frecom is the only one to fully create their own fax software. Breakthrough after technical breakthrough has given Frecom the

leading edge in both fax hardware and software. Why settle for second best when Tiger delivers the finest fax modems in the business at these incredibly low prices?

Tiger presents the price-busting fax board that has swept the industry, and captured *PC MAGAZINE's* "Editor's Choice" with its flawless reliability record. No other fax board can match Fax96's incredible 99.91% error-free transmission rating. In speed tests, using identical documents, Fax96 delivered a finished facsimile over fourteen seconds ahead of the nearest finisher.

For DOS users, the Fax96 screen looks just like your fax machine. View your document before you send it. Then, just click on "go" and the fax is on its way. For Windows, you get the amazing Fax Window software where faxing is as easy as printing. Either way, the fast, streamlined interface makes Fax96 a snap to learn and use. It saves time, money and effort.

What You See Is What You Fax!

Fax it fancy with big fonts, little fonts, picturesque graphics and more. For DOS users, Faxography will convert anything that can be printed on an Epson LQ printer to a fax. Simply set up your word processor, or any application, to use the Epson LQ printer, then print to a disk file (you don't need a printer at all). Faxography will do the rest. With Faxography you get completely formatted faxes with graphics and 648 EPSON printer style fonts. (Don't be fooled here. Some boards emulate 9-pin EPSON. Most emulate nothing at all. Fax96 does 24-pin emulation for the best quality images.)

Windows users can fax anything

From Your Screen To

a Fax In Seconds.

they see — including ATM scalable fonts, graphics, spreadsheets and more. The Fax Window fully supports all aspects of Windows 3.0 and 3.1.

The 1-Liner Advantage.

Need to share the fax line with your data modem and voice calls? Only Frecom offers the integrated solution — Fax96 1-Liner. This proprietary feature receives all types of calls — fax, data modem and voice — and routes them to the appropriate device — automatically!

An extra phone line costs money. Avoid this expense. Receive faxes, data and voice calls on one phone line even when you aren't there. The 1-Liner is a built-in voice/data/fax switch on the Fax96 fax board.

Ever been on the road wondering "did I get that fax yet?" You need the FarFetchFax™ feature.

Phone home and pick up your faxes as easily as picking up answering machine messages. In fact, do both at once. Listen to your phone messages, then enter your FarFetchFax code and tell Fax96 where to forward your faxes. That's unique. And every 1-Liner has it.

Includes Data Modem Too!

Every Frecom fax modem includes a built-in 2400 bps modem with all the latest technology. MNP5 and V42.bis compression features transfer your data up to 4 times faster for actual 9600 bps throughput. ZModem, XModem, YModem and other transfer protocols assure error-free transmissions everytime.

The Bulletin Board Host mode lets you get started with your own BBS. And the Scripting language lets you mold it all to fit any purpose.

Price-Busting Win*best* Series!

There's nothing to stop you anymore! Now every Windows user can put the power of a fax machine and data modem in their PC. Frecom, makers of the award winning Fax96, has dropped the bottom out of high prices to bring you this affordable, power-packed combo. Send faxes as easy as printing. Receive faxes silently in the background. Transfer files between bulletin boards and other offices with the built-in modem. It's all easy and affordable with the new Win*best* fax/data modem from Frecom.

Maximum-speed 9600 bps sending coupled with 4800 bps receiving make the Win*best* fax modems the value leaders. The included 2400 bps data modem lets your computer link up to other computers the world over. Plus you get all the software you'll ever need — both DOS and Windows versions.

Choose from the internal board that slips invisibly inside your computer, or get the sensational, new external modem that fits in the palm of your hand.

9600 & 14,400 Win*fast* Series

The top-of-the-line Win*fast* 14,400 fax/modem is a true work of art. All the latest technology is here. 100% Hayes compatible. Numerous compression techniques, like V.42bis that delivers up to 4:1 compression, meaning your data gets transferred 4 times faster — up to a screaming 57,600 bps! Think of the time and phone costs you'll save! The Win*fast* 14,400 is tomorrow's standard — but you can have it today.

NEW Fax Window 3.0

Frecom — the only fax modem manufacturer w
also designs and creates its own fax software — has j
released their award-winning Fax Window 3.0 softw

for sale separat
With over 3 years
fax experience, t
phenomenal s
ware package
features and be
fits no other
software can touc

Automatic ba
ground receivi
sending as easy
printing, fax/m
merge features w
ahead of the com
tition — it's all yo
with Frecom's
Windows 3.0.

Unattended, intelligent operation in the backgrou
automatically routes faxes to the Fax Window and da
calls to COMit for Windows. Not just for fax and da
traffic, ComPort Manager also works for remote cont
software like pcANYWHERE.

CXR/FRECOM FAX/DATA MODEMS

9600 Baud Fax With 2400 Baud Data Modem

BCW4702	**WIN*best* Internal Fax Modem** With DOS and Fax Window Software	$99.95
BCW4703	**Win*best* External Pocket Fax Modem** With DOS and Fax Window Software	$199.95
BCW6255	**Fax96 With Modem & 1-Liner** With DOS Software	$189.95
BCW6256	**Fax96 With Modem & 1-Liner** With Fax Window Software	$199.95

Win*fast* 9600 Baud Fax With 9600 Or 14,400 Baud Data Modem And Fax Windows Software

	Win*fast* 9600 Baud Fax / 9600 Baud Modem	
BCW6264	**Internal Model**	$299.95
BCW4746	**External Model**	$349.95
	Win*fast* 9600 Fax / 9600 Modem With One Liner	
BCW6263	**Internal Model**	$359.95
BCW4745	**External Model**	$419.95
	Win*fast* Band Fax / 14,400 Band Modem	
BCW6262	**Internal Model**	$419.95
BCW4744	**External Model**	$449.95
	Win*fast* 9600 Fax / 14,400 Modem With One Liner	
BCW6261	**Internal Model**	$429.95
BCW4743	**External Model**	$459.95

Fax Window 3.0 Software Available Separately

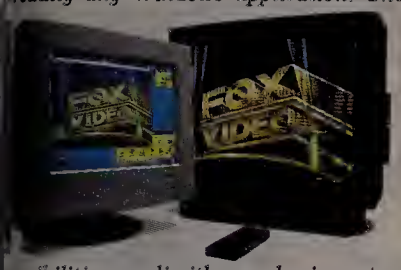
BCW6239	**Fax Window 3.0 Software Only**	$79.95

Requires IBM PC/XT/AT or compatible, 640K memory and hard disk.

Circle 214 on reader service card

IMPORT VIDEO INTO YOUR PC!

EVIEWER'S NOTEBOOK: *Anything you e on TV is now yours for the keeping! V, VCR, video camera, Laserdisc — any andard video signal — now plays in full otion right on your computer. See some- ing you like? Capture it! Use the image in rtually any Windows application. The*



ssibilities are limitless — business pre- ntations, computer-aided instruction, oint-of-sale displays and text/image atabases are just the beginning. Full- otion video and PC multimedia are pening doors to previously unimagined pplications. With Tiger's low break- rough price, it all can be yours today!

Professional, true-color video image pture used to be reserved for pros who id tens of thousands for the privilege. ut now anyone with a PC and Windows n have that same powerful capability. ith all of Windows' advantages you can atch TV full screen or scale magnifi- ntly to fit any size window. Shrink your V screen down to icon size and put it in e corner to watch while you work.

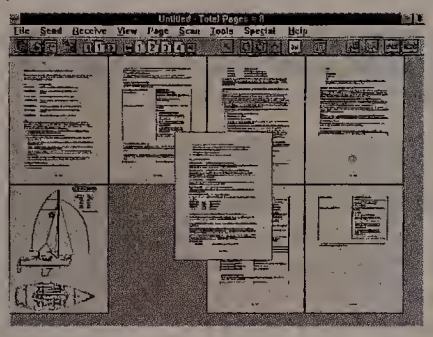
ADS

BCW3453 **Video Plus** **$499.00**

The Finest Windows Fax Software

REVIEWER'S NOTEBOOK: *At first glance we knew this was a winner — something brand new in the arena of advanced fax software. We could send faxes as easy as printing, receive them without a hitch in the background, view them with sparkling clarity on-screen and make any kind of changes — then send them out again without ever touching a printer or scanner! And the File Management system kept all our faxes perfectly organized. It was never the slightest problem to find the exact fax we were looking for, thanks to the Search Index and sorting capabilities.*

From the multi-page, thumbnail views of received faxes to the built-in drawing tools for fax mark-ups and editing notes, we knew this was a hit. Everything we could think of that we ever wanted for faxes was there.

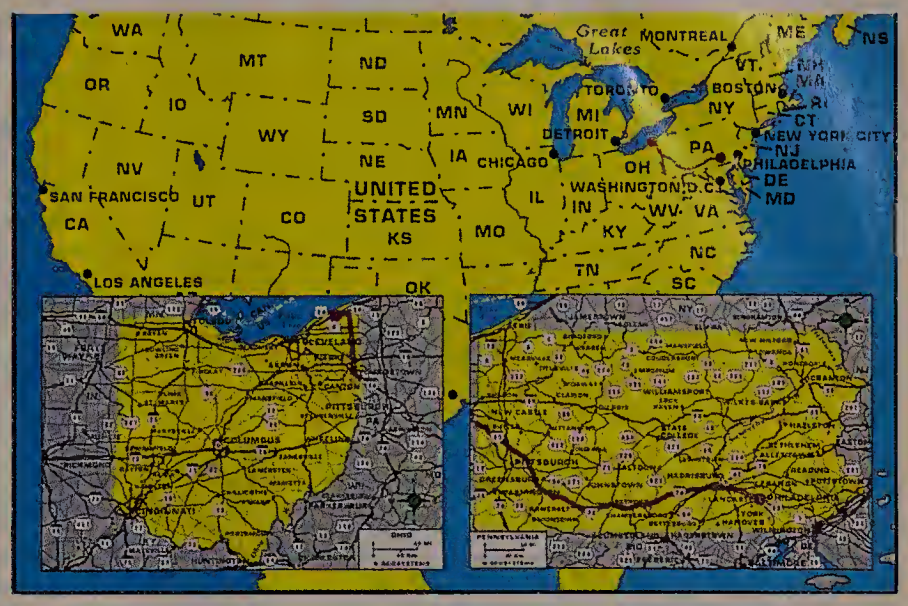


Thumbnail views of multi-page faxes make it easy as you insert, delete and rearrange your pages.

ECLIPSE FAX

BCW4774 **Eclipse for Windows** **$89.90**

Plan Your Vacation Or Business Trip With Pinpoint-Precision!



Brilliant maps from one of the world's most respected sources: GeoSystems. Clear, crisp images with your route highlighted. Here, a trip from Landisville, PA to Harpersfield, OH is shown. You select the most direct — or most scenic route.

REVIEWER'S NOTEBOOK: *Voyager is a CD-ROM based route planning system for Windows that provides clear, reliable directions TO any place — FROM any place in North America. Want to go from Disney World to the Grand Canyon? Just tell Voyager and in seconds you'll have complete directions with detailed maps and a highlighted route.*

Voyager includes megabytes of handsome, comprehensive maps like the ones you see on this page. You select the most direct route — or take your time, enjoy the drive and pick the most scenic route.

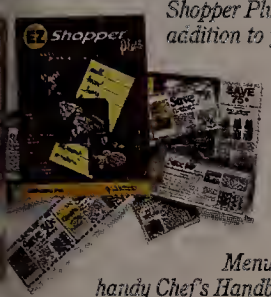
Planning a vacation or business trip is as easy as typing in your starting place and your destination. Voyager digs into its massive database of information, maps and statistics — and provides an instantaneous route plan, and points of interest along the way.

GEOSYSTEMS

BCW4792 **GeoSystem CD-ROM Edition** **$149.00**

Create Shopping Lists!

EVIEWER'S NOTEBOOK: *A nifty new pro- am that not only makes grocery shopping sier, it will save you money, organize your upons, provide nutritional information and en help you plan meals and store recipes. EZ-Shopper Plus is the perfect addition to your home PC, it contains 5 easy-to-use modules: Shopping Manager, Coupon Manager, Recipe Manager, Menu Planner and handy Chef's Handbook.*



EZSHOPPER PLUS

BCW4601 **EZShopper Plus** **$49.95**

New! Create Standalone Mini-Spreadsheets

aler Express actually enables you to create amperproof spreadsheets that you can dis- ribute (or SELL) to others, regardless of hat spreadsheet they have, even if they on't have a spreadsheet.

You create your worksheet as you normally would, then with just a few keystrokes Baler Express "compiles" into secure, self-running (.EXE) files.

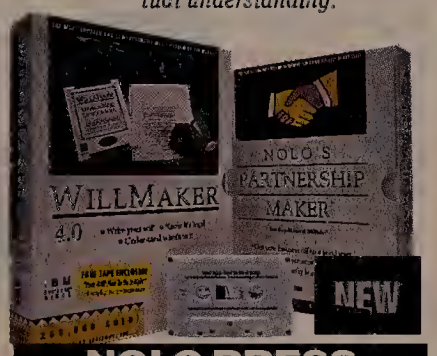
BALER EXPRESS

BCW6238 **Baler Express** **$99.99**

Plan A Partnership, Write Your Own Will.

REVIEWER'S NOTEBOOK: *Tiger and Nolo Press are proud to introduce a brand new release: Partnership Maker, enabling you to quickly and easily prepare a legal partnership agreement for any type of business. You'll avoid costly legal fees, customize your agreement to your specific needs — and get your partnership off to a solid start. Covers everything from co-ownership of a boat — to running a print shop and even organizing a safari!*

More and more people are deciding to go into business with friends, relatives, or work acquaintances. Often started with a handshake and the best of intentions, these partnerships frequently fail because of a misunderstanding or disagreement later on. The best and only way to avoid future misunderstanding is to start your business with a printed partnership agreement that clearly reflects you and your partner's mutual understanding.



NOLO PRESS

BCW3688 **Partnership Maker** . . **$89.95**
BCW3689 **WillMaker 4.0** **$39.95**

PUT CD-ROM ON YOUR NETWORK!

REVIEWER'S NOTEBOOK: *CD-ROM is exploding into the modern network; this product, CDNet™ is making the evolution possible. It allows multiple users on your network to share multiple CDs. The CDs can hold information that was previously published and distributed as catalogs, publications, regulations and reference materials such as legal, accounting or medical libraries.*

Suddenly, everyone in the workgroup has instant access to hundreds of thousands of pages of vital information. Today, thousands of "information sets" are available on CD. Titles in law, medicine, finance, government, science, manufacturing and more. Adding CD-ROM drives to your network will bridge the gap between the printed page and the computer screen...

CDNet's sleek, clean interface makes finding and retrieving any information title a snap, and you can connect an unlimited number of CD-ROM drives!

CDNet

BCW3311 **CDNet for Dos Starter Kit** **$495.00**
BCW3312 **CDNet for NetWare 10 User** **$645.00**

The Ultimate Calendar!

REVIEWER'S NOTEBOOK: *Finally, a sleek, powerful scheduling system that's truly easy to use. In fact, About Time is easier and more flexible than any other software attempt we've seen — and actually more convenient than written calendars. It offers a unique new concept in scheduling multiple people and resources, with daily, weekly, monthly and yearly breakdowns, instant viewing and in-depth management of time and schedules. Create an unlimited number of calendars on a PC or network. Group Calendars, Appointments, Memos, Reminders and Things To Do are tracked for you — just "jot them down anywhere" in About Time.*

Need to track and schedule to the minute? Each user can instantly display their calendar in 1, 5, 10, 15, 30 minute or 1, 2, 4, 8 or 12 hour increments. Schedule individual appointments as well as recurring ones, and don't ever get stung by another "forgotten" conflict. Quickly move in and out of the calendar by using the built-in TSR option. Search for your appointments by key words, view appointments for multiple users concurrently.

ABOUT TIME

BCW3301 **About Time** (Single User). **$79.90**
BCW3302 **About Time Network** **$295.00**

Circle 214 on reader service card

Turn Any Fax Into A Full Page Scanner!

REVIEWER'S NOTEBOOK: *It's not everyday something really new comes along, but here's an ingenious breakthrough; a little black box the size of a Chunky chocolate bar that lets you use your desktop computer or portable to scan, fax and print using a fax machine! Imagine, you're in the office or on the road and all you need is your desktop or portable. In a second, you plug into an office or hotel fax machine to satisfy all your scanning and printing needs. With fax machines popping up in airports, hotels, supermarkets and stores all over the world, you'll never be without scanning or printing facilities again.*

Introducing a new era in truly portable computing: FAX SCANNER. This 1⅞"×2¼"×⅞" wonder-device connects your computer and fax/modem (Class II with send and receive capabilities) to any standard fax machine (Group III, the most common around) for incredible scanning power!!! This system is the best solution we've ever seen for top-quality full page scanning. The superb gray-scale images and crisp, clear text are simply unbeatable and ideal for OCR processing. We tried with the best full-page scanners to duplicate FAX SCANNER's quality; but it just didn't compare. Everything about FAX SCANNER is fine tuned for quality scanning.

Scan a full 11"×17" size (depending on your fax machine) with the included software. Save it as a .PCX image file, then import your scanned image into PageMaker or virtually any software package which recognizes .PCX files. This includes word processors, paint programs, and practically all desktop publishing software, even WORLDFAX! You get all the power of a full-page scanner, including 16 levels of grey, in a package small enough to fit in your shirt pocket for an unbelievable low price.

WorldFAX Software

Here's the easiest way we've seen to create and send a fax from DOS. From true graphics display with scalable fonts, to the impressive ability to import an image with effortless simplicity, WorldFAX is a world class fax software.

WorldFAX allows you to easily use your existing fax/modem (Class II) to compose outgoing faxes and silently receive faxes in the background. Need just the right font to add spice to your fax? Select any from thirty types of fonts and four types of styles, any size for just the right look. Later on, if you decide you want more fonts, you can select from the huge font library from Atech Software.

Perhaps most impressive is the ease with which WorldFAX handles graphics. Simply drop your image in, move it around and resize it for just the right look.

For the creative user, WorldFAX supports 16 levels of grey scale. By combining all the different features, one can compare WorldFAX to a desktop publishing software with the ability to fax out and receive professional composed documents.

Organize, track your faxes and log the calls you make with WorldFAX's easy-to-use menus. Tell WorldFAX to send your faxes late at night when the rates are cheaper and you're at home getting a good night's sleep. Even more, WorldFAX will automatically organize and file your incoming faxes, according to time and date received.

Use Any Fax To Scan AND PRINT!

For the ultimate in high-tech compact portable computing, the combination of WorldFAX and FAX SCANNER provides the user the capability to use any fax machine as a laser quality printer. Print spreadsheets, pictures and any document at a sharp 200 DPI. You can even print images with 16 levels of gray shades without having a postscript laser printer. With a plain paper fax machine y get top, laser-quality 300 DPI output, great for the bu office. For the person on the road, the portability of th system is a must, now you can print or scan your doc ments wherever you have a fax machine (office, superma kets, airports, hotels, etc.) and all for fractions of the pri of a hand-held scanner or a laser printer!!!

SVA SOFTWARE INC.

BCW6290	**FAX SCANNER**	$69.00
BCW6294	**FAX SCANNER** with pocket fax modem	$199.00
BCW6291	**WorldFAX Software**	$99.00
BCW6292	**WorldFAX Software** with FaxScanner (includes fax printing capabilities)	$149.00
BCW6293	**WorldFAX Software** with FaxScanner and pocket fax modem (includes fax printing capabilities)	$249.00

Requires hard disk, VGA monitor, and fax modem.

Take This Simple Coprocessor Quiz:

1. Do You Use A Spreadsheet?
If you do, then you're probably spending double or triple the amount of time finishing charts and performing massive calculations. A math coprocessor would shave hours off of your work by accelerating these tasks by hundreds of percent. The IIT 3C87 coprocessor, for example, runs like the wind with over 2,000 applications and is 100% hardware compatible with hundreds of configurations.

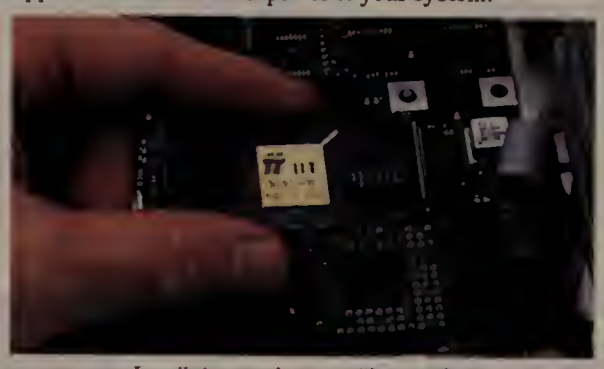
2. Do You Display & Print Graphics?
You're probably growing old waiting for screen redraws and color enhancements, font handling, Postscript emulation and image generation if you don't have a coprocessor. Why wait when the IIT 3C87 coprocessor provides the missing element in desktop design and page layout: speed.

3. Are You A CAD User?
Don't even attempt to begin technical drawing without a math coprocessor. Redraws, hidden line removal and scaling will kill you. Just call us and order the IIT coprocessor. The IIT 3C87 is the smartest investment in coprocessors right now.

By now, you've noticed that the IIT 3C87 Advanced Math Coprocessor is the one that we suggest. Designed, tested and guaranteed for 100% compatibility, this spitfire is compatible with all 386DX systems and software, and is fully compatible with all 8087 and 80287 program codes.

The IIT 3C87 carries a FULL LIFETIME WARRANTY! You can count on the 3C87 to pump out the power for as long as you own your system.

There's a coprocessor for any specific need you have. Increase your speed and efficiency — call Tiger today. One of our representatives can help you add the perfect horsepower to your system.



Installs in seconds — runs like a spitfire!
Compatible with thousands of software applications!

IIT MATH COPROCESSORS

CALL FOR COMPATIBILITY

BCW6017-03	**2C87** (286 8MHz)	$69.95
BCW6017-10	**2C87** (286 10MHz)	$69.95
BCW6017-12	**2C87** (286 12MHz)	$69.95
BCW6017-16	**2C87** (286 16MHz)	$79.95
BCW6017-20	**2C87** (286 20MHz)	$79.95
BCW6018-16	**3C87SX** (386SX 16MHz)	$79.95
BCW6018-20	**3C87SX** (386SX 20MHz)	$79.95
BCW6018-25	**3C87SX** (386SX 25MHz)	$79.95
BCW6018-33	**3C87SX** (386SX 33MHz)	$89.95
BCW6019-16	**3C87DX** (386DX 16MHz)	$89.95
BCW6019-20	**3C87DX** (386DX 20MHz)	$89.95
BCW6019-25	**3C87DX** (386DX 25MHz)	$89.95
BCW6019-33	**3C87DX** (386DX 33MHz)	$89.95
BCW6019-40	**3C87DX** (386DX 40MHz)	$99.95

Call for suggested model number.

Add A Second Hard Drive For Just $99!

Data Compression at its finest, thanks to XtraDrive's highwatermark technology.

It doubles the size of your hard disk instantly. Install XtraDrive in just a few seconds, with a couple of menu commands. While the competition makes you rewrite your CONFIG.SYS and write compressed files to a new drive designation — XtraDrive requires none of that.

It is compatible. It compresses any data file. Unlike the competition, which will not compress Windows swap files, or QEMM Optimize, or Norton Utilities Speedisk, or PC Tools — or many others — XtraDrive manages the process from the BIOS level, totally transparent to the system. This allows XtraDrive to compress anything!

Your data is safe. No other product safeguards your data with such muscle as XtraDrive. How? XtraDrive actually maintains two copies of your data at all times during installation.

XtraDrive is the best in the business and it costs less than the competitors.

XTRADRIVE

BCW6021	**XtraDrive**	$79.90

Windows Acceleration

This board is packed with immens power, including a 300 mips RIS processor with micro-coded graphics i structions and 1Mb high speed VRAM Color support is magnificent: 63,53 colors in 640-by-480 to 1024-by-76 resolution modes — with maximum res lution of 1280-by-1024.

PC Magazine said "The Xgraph achieves the highest rating so far in P Labs' Winbench tests, performin nearly 14 times faster than a VRAM in 1024-by-768 and 256 color mode This baby is up to 20 times faster tha Super VGA.

Xgraphic has been carefully designe to speed up Windows graphics — and d it exceptionally well. It will provide a the speed you need well into the ne generation of Windows accelerator card with solid design, unmatched compat bility and smooth power.

The Xgraphic board is optimized fo Windows, autocad and auto shade an operates u to 75h refresl rate for crisp flicker free screen Xgraphi carries 5 yea warranty.

XGRAPHIC

BCW6022	**Xgraphic**	$299.00

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M-F 8am-Midnight, Sat. 8:30am-8pm & Sun. 11am-5pm (EST)

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Complete NEC CD-ROM KIT: JUST $399

Ready To Run—Includes Reader, Interface And Cables.

The best value in CD-ROM! This speedy CD-ROM reader from NEC — with FREE interface kit is now just $399. This value is unmatched anywhere in the industry. If you're thinking about getting into CD-ROM; or upgrading your current reader, here's your chance. By the way, the retail price of the reader alone is $675 and the inter-face, $89 — That's over $840 total value for just $399.

Not just a great price, a great value -- NEC readers have the highest reliability rating of any reader made, and with its incredible speed — it outruns them all.

It's a wonderful world of educational and reference works, literature, the arts — even sight and sound with the magic of the CDR-73.

When you purchase one of these fine readers, you can also get deeply discounted prices on two value-packed bundles we've assembled. Own them both and you'll have the wisdom, knowledge and delight that would fill thousands of books!

Complete Kit, Just $399

The lowest price ever on these CD-ROM speedsters! Don't buy an off-brand! Get the best for about the same price. Includes cable and complete interface kit, making this the absolute best value in the business! The reader features advanced optics and precision workmanship, and is built to run reliably first time, every time.

Tiger Starter Kit #1

(Just $159.95 when you buy a reader) This is our most popular bundle package, featuring the hottest CD titles — with a retail value of over $1000! Titles include Great Cities of The World, World Atlas, U.S. Atlas with AutoMap, Time Compact Almanac, The Toolworks Illustrated Encyclopedia, Publish-It! 2.0 Desktop Publisher (complete with clip-art and fonts) and more.

Tiger Starter Kit #2

(Just $149.95 when you buy a reader) A bundle with something for everyone! Includes Animals, TimeTable of Science and Innovation, U.S. History, Sherlock Holmes Interactive, Game Pack II and more. A great mix of games, literature, history, science and fun!

TIGER CD-ROM

NEC EXTERNAL CD-ROM DRIVE
CDR 73 CD-ROM Reader with Complete Interface Kit

TIGER SPECIAL — JUST $399

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CD SpeedWay
Great Cities of the World
World Atlas
U.S. Atlas & Automap
Reference Library
Time Compact Almanac
Toolworks Illustrated Encyclopedia
Magazine Rack
Publish It 2.0 w/Clip Art & Fonts
Q&A
TOTAL FOR STARTER KIT 1 ..... $159.95

STARTER PACK 2
New! Animals
Time Table: Science and Innovation
U.S. History
Family Doctor
Sherlock Holmes
Game Pack II
Wing Commander & Ultima VI
Loom
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TOTAL FOR STARTER KIT 2 ..... $149.95

THE CDR 73 WITH STARTER PACK 1

THE CDR 73 WITH STARTER PACK 2

NEC CDR-73

BCW8273 **NEC CDR-73 Drive** Interface & cable included $399.00
BCW8673A **Tiger Starter Pack I** $159.95
BCW8673B **Tiger Starter Pack II** $149.95

Data Modem, Fax & Answering Machine In One!

No better value for the savvy businessperson when it comes to communications -- one machine that does the work of three! Turn your PC into a data modem/fax machine/answering machine!

The compact, internal Home Office is one of the hottest devices in the industry right now. A speedster at 9600 bps fax send and receive. With Group III compatibility and a full-featured 2400 bps data modem, it's all you'll ever need. The Home Office is Hayes compatible and comes complete with MaxFax software and all necessary cables.

Also check out the Fax Line Manager from Technology Concepts, Inc. This ingenious little box transforms a single phone line into voice, fax, modem and answering machine phone lines. Fax Line Manager decides what kind of call it is and routes it to the right device.

PROMETHEUS/TCI

BCW6271 **Home Office** $239.00
BCW6272 **Fax Line Manager** 202 .. $115.00
BCW6273 **Fax Line Manager** 203 .. $139.00
All modems come complete with software and cables.

Raise A Child Who Loves To Learn!

Phonics Plus (Ages 4-8)

...makes a lively game of working with vowels and consonants. Colorful screens, friendly characters, various play and learning levels. Continually challenges the child to expand knowledge of letters, sounds and use of the PC.

2nd Math (Ages 7-16)

Mathematics is easy and fun when children are taught with personalized learning tools. That's the secret of 2nd Math, a wonderful software program filled with car races, puzzles, time tests and more. Covers beginning addition up to fractions, decimals and pre-algebra.

The PC Speed-Reading Course

Speed reading courses can be helpful, but skills must be constantly maintained to realize long-term gains. That's where BookMaster for SpeedReading comes in. It's a PC program that not only improves the speed of your reading, but increases your comprehension as well. The techniques you learn in BookMaster for SpeedReading will become habits — and that means constant improvement.

STONE SOFTWARE

BCW3286 **Phonics Plus** $39.95
BCW3288 **Talking Phonics Plus** ... $49.95
BCW3287 **2nd Math** $49.95
BCW4700 **BookMaster for SpeedReading** $59.90

Try FileMaker For Windows: $99!

Here's the most popular Macintosh database — available for the first time for Windows! Simple to use, yet extremely powerful — you can actually create your own databases WITHOUT PROGRAMMING — just pop up the sleek menu to access FileMaker Pro's enormous power! Enables even first-time database users to organize information, create invoices, manage mail-lists and much more. Import and export data quickly, and link to other FileMaker Pro files to retrieve related data.

If you've always thought putting together your own database was tough — you CAN do it with FileMaker Pro for Windows. All in all, FileMaker Pro for Windows is the smartest way to create your own database solutions.

FILEMAKER

BCW3963 **FileMaker Pro Comp. Upgrade** $99.00
BCW3964 **FileMaker Pro** $299.95

The Computer Time Machine

What was going on in the world the day you were born? Who was on the top of the music charts or who was the year's best in sports? Just enter your birth date and instantly News Of The Past displays and prints a complete rundown of significant events in a handsome, framable format. A great gift, perfect party activity -- even a lucrative business opportunity!

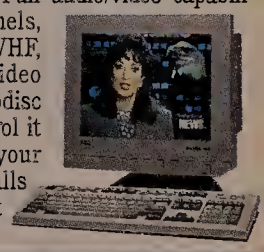
INCLUDES 25 PRE-PRINTED FORMS

NEWS OF THE PAST

BCW3289 **News Of The Past** $49.95
Call for system requirements.

Watch TV On Your Computer!

This patented add-on board (that installs into XT/AT expansion slots) actually delivers higher resolution than your TV set — full VGA quality picture. It is fully compatible with both DOS and Windows-based systems. Full audio/video capabilities, 119-channels, standard cable, VHF, UHF, VCR, video camera or videodisc — and you control it all right from your keyboard. Installs easily in just minutes.



DESKTOP TV

BCW3882 **Desktop TV** $249.00
Call for system requirements.

Information & Orders: **1-800-888-4437** Int'l Orders: 305-443-8212 Fax: 305-529-2990 We Ship Via Federal Express

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- Memory
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Fully Upgradable Intel 80486 CPU
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210MB 12ms Hard Drive w/cache 420MB with Stacker®
Non-Interlaced 14" Super VGA Color Monitor
24 Bit 1MB Graphics Accelerator Super VGA Video Card - Up to 16 Million Colors
1.2MB 5.25" Floppy Drive
1.44MB 3.5" Floppy Drive
2 Serial Ports, 1 Parallel, 1 Game Port
Enhanced 101 Key Keyboard
MS-DOS 5.0
Mouse
Desktop Case, Full Vertical Available
Stacker and Dr. Solomon's Anti-Virus™ Software

intel inside

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486-33MHz (SUPER BUY!)	$1,899
486DX2-50MHz	$1,999
486-50MHz	$2,099
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Need a fully-loaded, value-packed '486 right now? No problem! We've specially configured and pre-built our hottest selling systems and they're ready to ship today! Plac your order before 5 P.M. (MST) and we'll ship your computer within 24 hours!

*The fine print.

- This offer is good as long as these pre-built systems are in stock.
- Order by 5 P.M. (MST) Monday thru Friday.
- Order is subject to credit approval. P.O.'s subject to additional conditions.
- You must order a 486 ISA as listed here (Custom orders take a tad longer).

CD-ROM

Talon (SUPER BUY!) TA-100

Internal, 380ms access time, 32KB buffer, fast transfer rate. $279

Sony S-535

Internal, 340ms access time, 8KB buffer, 150KB/second transfer rate. $399

Talon High Performance TA-200

Internal, 280ms access time, 64KB buffer, 300KB/second transfer rate. $599

Free with any CD-ROM drive -
- 1992 Multimedia Encyclopedia
- Stereo Headphones
- Reference Library
- Game Pack.

1992 Toolworks Multi-media Encyclopedia - complete 21 volume set. Over 33,000 articles with 3,000 pictures, 250 maps, 35 minutes of video, 35 minutes of sound recordings and 55 video sequences.

CD Software - Pick any 5 for $99*

Aircraft Encyclopedia	Nat'l Parks
Bible Library	Plant Doctor
Career Opportunities	Reference Library
CIA Factbook	Sound Works
Civil War	Space-Apollo
European Monarchs	Timetable of Arts
Game Pack II	Timetable of Sci.
Guinness Disc	USA State Fact Book
Great Cities (MM)	US Atlas
Interactive Storytime	US Civics
KGB Factbook	US Presidents
Korea	Vietnam
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The Complete Guide to the New CPUs

Buy a PC without knowing the performance of the CPU inside it, and you're buying blind. Shed some much-needed light on the subject with this comprehensive guide.

The chips! They're multiplying!

Like products of a wayward genetic experiment, CPUs keep splitting into subcategories of subspecies, confounding anyone who has to choose one breed of PC. Few can say proudly, "I'm getting a new 486 PC" without wondering privately, It *is* fast, isn't it?

Indeed, the definition of *fast* changes faster than Intel can invent names for processors. When it comes to raw horsepower, the truth is that CPUs have never advanced so quickly. Intel alone introduced more than 30 new processors this year, two of them more powerful than any predecessor. This parade of CPUs has made many users give up trying to tell one chip from another.

Why the breakneck pace? Because Intel is no longer alone: Cyrix, Advanced Micro Devices (AMD), IBM, and Chips and Technologies have all jumped into the CPU business, forcing Intel to bring forth new generations of chips faster and at lower cost. Incredibly low system prices—and a dizzying array of choices—are the result.

Learn to tell the fast chips from the fastest, and you'll not only have a good idea of what performance you're buying, you'll be able to cash in on the hottest trend in PC architecture: upgradable CPUs. With many of today's systems, you can pull the original chip and pop in more powerful ones. You can even bump the clock speed from, say, 25 MHz to 33 MHz. Know the fastest

By Eric Knorr

NICK FAIN

66
50
25
13
40

33-MHz upgrade chip you can buy, and you have a good idea of that PC's performance ceiling.

To paint a clear picture of how 19 of today's CPUs perform relative to one another, we've drawn on the results of hundreds of system benchmarks. Instead of low-level tests that measure theoretical processing limits, we've used our standard *1-2-3* and *Windows* benchmarks—both good measures of real-world performance—to show how each processor affects the pace of your work.

To be sure, there's more to a system's performance than its CPU: Caching, video, and disk throughput all play important roles. In some cases, adding a graphics accelerator or more memory may actually boost your system more than a double-speed CPU upgrade. However, with most apps, that tiny computing engine with micron-wide traces is still the major factor in determining whether you'll be satisfied with your PC's performance.

Don't buy a desktop that uses an Intel 386. You may save a little cash up front, but PCs based on Intel's 486 now clearly offer better performance for the money.

You Can't Judge a Chip by Its Megahertz

A CPU's clock speed, measured in megahertz (MHz), is like a car engine's RPM, only with the throttle stuck at one speed. Just as a larger engine can haul a bigger load than a smaller engine running at the same RPM, so a more powerful processor can do more work than a less powerful one running at the same clock speed.

That's exactly the situation with the 386 and the 486. The 33-MHz 486 CPU delivers nearly double the processing power of a 33-MHz 386—despite their identical clock speed. Advanced 486 technology has made the 386 virtually obsolete, except in laptop designs where battery power consumption is critical.

To put it bluntly: Don't buy a desktop that uses an Intel 386. You may save a little money, but PCs based on Intel's 486 now clearly offer the best price/performance—within the Intel family, that is.

Makers of Intel-compatible chips are keeping the 386 alive. IBM's 20-MHz 386SLC, which fits in a 386SX socket, uses an 8K cache (and other 486-like tricks) to deliver more than double the performance of a 20-MHz 386SX. IBM's new Value Point Model 325, which proffers an AT bus and an aggressive price, includes a 25-MHz version of the 386SLC that should provide performance comparable to that of a 25-MHz 486SX, which has become the entry level for business computing.

AMD, which is Intel's chief competitor these days, offers a 40-MHz 386DXL that also delivers performance in the 486SX/25 range (see "486SX/25s vs. 386DX/40s: The Upstart Fights Back" in this issue). Systems with 40-MHz 386 chips tend to be amazingly cheap—less than $2000 with 8MB of RAM, a large hard disk, and a monitor. However, we've seen only two 40-MHz 386 PCs out of dozens that offer an inexpensive, chip-level upgrade. That kind of flexibility can double the useful life of your PC, and nearly all 486SX systems offer it.

Smart Upgrades and CPUs

Windows

Video
A Windows accelerator card can improve performance by a factor of three with some applications.

CPU
Upgrading from a 25-MHz 486SX to a 25/50-MHz OverDrive delivers a 30 to 50 percent speed boost.

Math coprocessor
Has no effect on Windows itself.

Memory
Upgrading from 2MB to 4MB can double performance, but adding more has little effect for most users.

Hard disk
Caching controllers appear to have little advantage over disk caching software.

1-2-3 for DOS

Video
Fast video boards have little effect on character-based DOS applications such as 1-2-3.

CPU
Upgrading from a 25-MHz 486SX to a 25/50-MHz OverDrive makes non-floating-point operations run about twice as fast.

Math coprocessor
Included in the OverDrive chip, the math coprocessor doubles the speed of floating-point operations. Overall, the coprocessor-plus-CPU upgrade speeds these operations by 350 percent.

Memory
If your biggest spreadsheet can fit in RAM, adding more won't get you anywhere.

Hard disk
1-2-3 holds as much data as possible in memory, so disk speed has little effect.

A CPU upgrade delivers the biggest speed boost across the broadest range of applications. However, as you can see from this figure, you may enjoy an even bigger performance increase by upgrading other components, depending on your application. For example, a fast video board may deliver a huge acceleration under Windows, but have little effect with 1-2-3.

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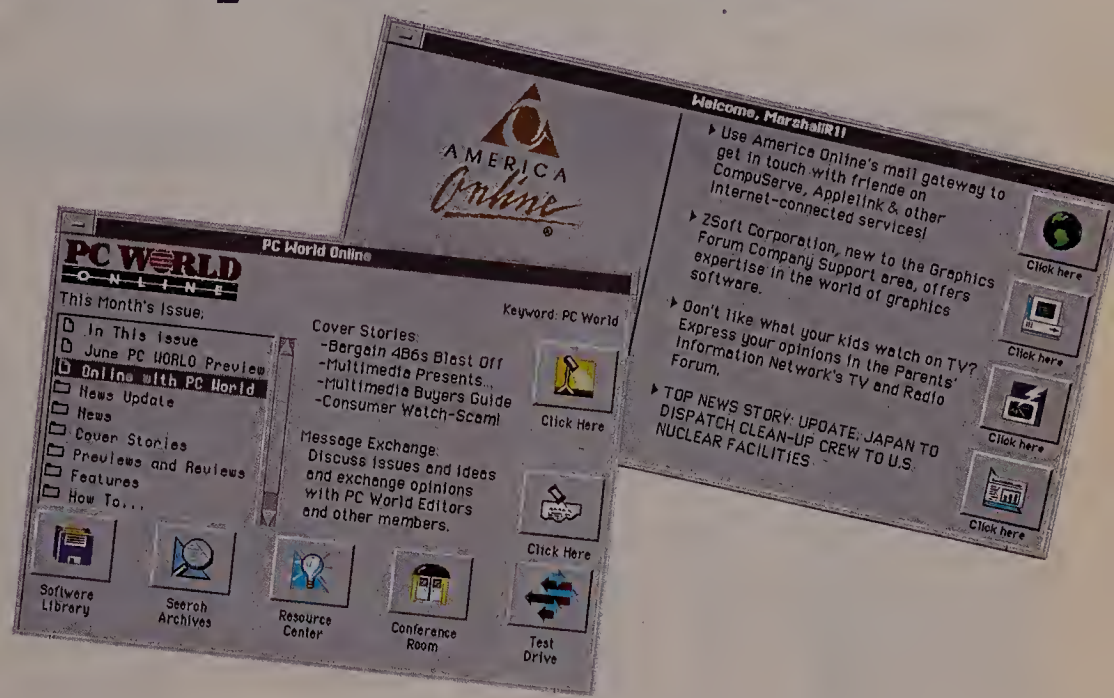

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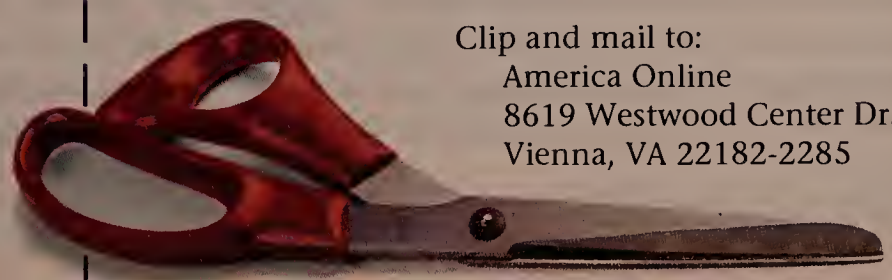

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Swap Chips and Hang On Tight

Yes, unlike the car engine, the CPU is now just another replaceable part—and it pays to know what you're replacing. Today's 486 chips for desktop PCs fall into six classes: Intel's 486DX, 486SX, OverDrive, and 486DX2; IBM's 486SLC; and Cyrix's 486SLC. As you're probably aware, the 486DX is a 386-compatible CPU with a very fast RISC core, 8K memory cache, and cache controller, plus an enhanced, 387-compatible math coprocessor. The 486SX is the same chip as the DX—except the math coprocessor has been omitted or permanently disabled. Systems with 486SX chips commonly go for under $2000 with all the trimmings and offer a smooth upgrade path to more powerful CPUs.

That path begins with the OverDrive chip, a supercharged version of the 486DX. An ordinary DX runs at the speed set by the system's clock chip, while the OverDrive's *internal* processing speed is double that of the clock. You won't get an across-the-board, 100 percent performance boost when you plug in an OverDrive (remember that video, memory, and disk throughput remain mostly unaffected), but the 30 to 70 percent speedup you *can* expect with most business applications is nothing to sneeze at. And as our *1-2-3* benchmark shows, because the OverDrive adds a coprocessor, numeric-intensive applications may execute a whopping 3½ times faster than with the original 486SX chip.

Originally, OverDrives were designed to plug into a special sock-

TEST REPORT

How the Chips Stack Up

*With optional math coprocessor

Culled from benchmarks of more than 300 PCs, the graphs above show the relative performance of 19 classes of systems, from the 20-MHz 386SX all the way to the 66-MHz 486DX2. The Windows chart gives you the best idea of how systems based around a given CPU will perform across a range of business applications. The 1-2-3 test highlights the benefit of a math coprocessor, either optional (as noted) or on chip (all 486DXs, DX2s, and OverDrives). All chips are from Intel unless otherwise noted.

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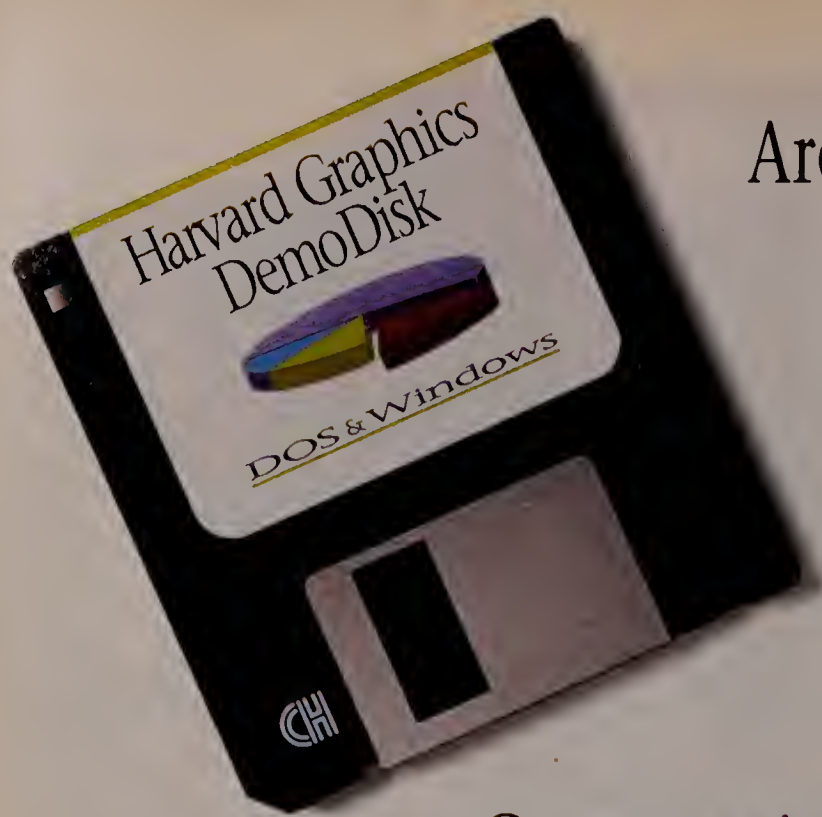

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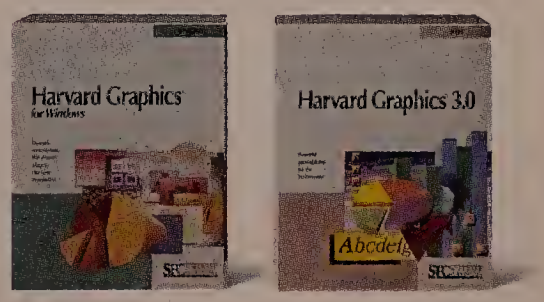

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et offered only by 486SX systems. Today, Intel also offers OverDrives for 486DXs: You (carefully) pull the original CPU and plug in the OverDrive. Aside from a single pin, there's no difference between SX and DX OverDrives. Intel claims that DX OverDrives will work in "the majority" of DX systems. (If you already have a 486DX or plan to buy one, the table below lists 80 systems that Intel has successfully tested with the DX OverDrive.)

Intel sells OverDrive chips retail (they list for $499 to $799, depending on the type and clock speed), while it offers 486DX2s to system vendors only. That, believe it or not, is the single significant difference between OverDrives and DX2s. The double-time DX2 lets system manufacturers use existing motherboards with inexpensive components rated at 25 or 33 MHz. The result? You can buy a fully loaded DX2-66 (at press time, the fastest PC available) for less than $3000 from a reputable vendor offering excellent service and support—an unprecedented value.

Compatibility with existing motherboards is the idea behind IBM's 486SLC2. Pin compatible with Intel's 386SX, this chip mimics the DX2's ability to run the processor at twice the motherboard clock speed. And with a 16K internal cache, the chip won't have to fetch from slow main memory as often as Intel's 486s. Preliminary benchmarks indicate the 20/40-MHz IBM 486SLC2 delivers performance significantly better than Intel's 25-MHz 486SX. This CPU recently made its debut in IBM's Premier PS/2 line.

Finally, we come to the cult favorites: the Cyrix 486SLC and 486DLC. Whether the Cyrix 486SLC deserves to be called a 486 is

Intel's Hot List–486DX PCs That Accept OverDrives

Thought your 486DX PC had reached its performance limit? Not if it's on this list. Intel's own tests indicate that you should be able to pull your old 486 CPU and install a speed-doubling OverDrive in any system listed below (though you may have to update your BIOS or move a jumper). The 25/50-MHz version retails for $599, while the 33/66 retails for $799; both can be had for less through your local dealer or superstore. If you experience unresolvable compatibility problems with any of the following systems,

33-MHz units upgradable to 66 MHz

Vendor	Model	BIOS revision
ACER	AcerFrame 3000SP	no
ADAC	Industrial Rack Mount 1800 Series	no
ALR	BusinessVEISA 486/33	yes
AMERICAN MITAC	4280G	no
AMERICAN PACIFIC COMPUTERS	AP 486	no
AMKLY SYSTEMS	486/33E	no
APRICOT COMPUTERS	FTE 486	no
ARIES	Contaq 486/33	no
AT&T	Star Server 486/33	no
BMC	Phoenix 486/33	no
CIC COMPUTERS	Sigma	no
COMET DATA	CH 486	no
COMMODORE	CL433	no
COMPAQ	Deskpro 3/25i	no
	Deskpro 3/33i	no
	Deskpro 4/33i	no
	Deskpro 486/33L	no
	Deskpro 486/33M	no
	Portable 486	no
	Portable 486C	no
	Prolinea 4/33	no
	Systempro LT Model 486/33	no
	Systempro Model 486/33	no
COMPUADD	433EISA	no
	CompuAdd 433	no
COMPUTER MARKET PLACE	CMP Ultra 486	no
DEC	DECpc 433 Workstation	no
EPSON	Express Station EISA	no
EVEREX SYSTEMS	StepServer 486/33	no

Vendor	Model	BIOS revision
FOUNTAIN	FTN-486DX/33	no
GATEWAY 2000	4DX-33 486DX-33 ISA	no
HEWLETT-PACKARD	Vectra 486/33T	no
	Vectra 486/33U	no
HQ	HQ 486-33I	no
HYUNDAI	Corporate Series 486/33	no
IBM	PS/2 Model 90 XP 486	no
	PS/2 Model 95 XP 486	no
ICL	Model 75	no
LEADING EDGE	Model D4/33	no
MICRO EXPRESS	MicroFlex 486	no
NCR	Model 3345	no
NEC	PowerMate 486/33e	no
NORTHGATE	Elegance ZXP System	no
	Elegance ZXP33D	no
NOVUS	Novus PC 486DX/33 ISA	no
OSICOM	Executive SL486/33	no
PACKARD BELL	Force 486/33	no
R&D	Mint 486	no
ROYALE	486/33	no
SIMPLY COMPUTERS	486/33	no
TANDY	Tandy 4833 LX/T	no
TULIP	Vision Line TR486 DX/E	no
VIGLEN	Genie Executive 4DX33	no
	IV/33	no
ZEOS	Zeos Upgradable 486DX/33	no

debatable, since its performance at 25 MHz hovers just under that of the 386DX-33. However, Cyrix's 33-MHz DLC does considerably better, racking up scores similar to those of a 25-MHz 486SX. Cyrix's 486DLC has the same pinout as a 386DX, enabling manufacturers to drop the chip into existing 386DX designs with only minor modifications. Austin, PC Brand, and a handful of other manufacturers have already adopted the Cyrix 486DLC, and more are sure to follow.

> "Imagine you could pop an accelerator chip into your flagging 386 and enjoy the steroidlike effects. By mid-1993, you'll be able to buy a muscular chip at a bargain price and do just that."

Imagine you could do that yourself: Pop a Cyrix chip in your flagging 386 and enjoy the steroidlike effects. Guess what? By the middle of next year, you'll probably be able to buy a muscular Cyrix chip—at a bargain price—and do just that. The company plans to introduce a chip that's pin-compatible with the 386 and uses clock-doubling technology à la OverDrive.

Intel will refund your money. The company is constantly updating this list, so check with Intel for the latest update if you don't see your system. Call 800/525-3019 to have the information automatically faxed to you.

25-MHz units upgradable to 50 MHz

Vendor	Model	BIOS revision
ACER	AcerPower 486e	no
ALR	BusinessVEISA 486DX	yes
AMKLY SYSTEMS	486/25E	no
APRICOT COMPUTERS	VX FT Server Series 400	no
ASEM	486/25	no
AST	Bravo 4/25s	no
BOSS TECHNOLOGY	Series 486	no
COMPAQ	Deskpro 486/25	no
COMPUTER MARKET PLACE	CMP Ultra 486	no
EVEREX SYSTEMS	Step 486	no
GRID SYSTEMS	486EI-25	no
HEWLETT-PACKARD	Vectra 486/25T	no
IBM	PS/2 Model 90 XP 486	no
	PS/2 Model 95 XP 486	no
NCR	Model 3300	no
	PC-486/MC	no
NEC	BusinessMate 486/25E	no
OLIVETTI	CP 486	no
	P750	no
SAMSUNG	SystemMaster 486/25TE	no
SNI	PCD4T/25	no
TATUNG	TCS-9000T	no
TULIP	486/25	no
UNISYS	PW² Advantage 4256	no
WYSE TECHNOLOGY	Decision 486/25	no

But Are They Really Compatible?

Now imagine this: You buy a system with a fast Cyrix CPU, and your favorite applications start crashing all over the place. You curse the day you read about clone CPUs in *PC World*. A likely scenario?

Remotely possible, but there's almost no chance that Cyrix's CPU would be the culprit. Labs from here to Conshohoeken have tested the compatibility of Cyrix, AMD, and IBM processors, and no one, not even Intel, has cast aspersions on these clones' ability to run every software package an Intel processor can run.

Here's the rub. When any company, Intel included, comes out with a new processor, problems sometimes do emerge. Usually they're caught before the chip ships, but, to take one example, Intel shipped thousands of 486DXs before it caught a glitch in the on-chip math coprocessor.

New chips also demand system manufacturers that can support the new technology effectively. The PC World Test Center encountered several Cyrix SLC and Intel DX2 systems that exhibited software glitches, which the PC vendors admitted were related to BIOS's and support logic that didn't quite jibe with the new chips. In all cases, the problems were quickly corrected by the vendors.

Does this mean you should wait until a chip has a proven track record before buying a PC built around it? In reality, the risks of getting burned by new technology are low, as long as you buy from a system company that offers a good turnaround policy on replacements and repairs. You're far more likely to encounter problems with your hard disk than with a cutting-edge chip or even its motherboard. In short, if you're covered, you're covered.

System vendors almost always discover a chip's problems before the PC gets near you. For example, Chips and Technologies came out with three CPUs last spring, but testing turned up enough difficulties with the company's two 386 compatibles so that neither made it to market. Currently, C&T is promoting its 8086-based "PC on a chip," a highly integrated, low-power unit for palmtops.

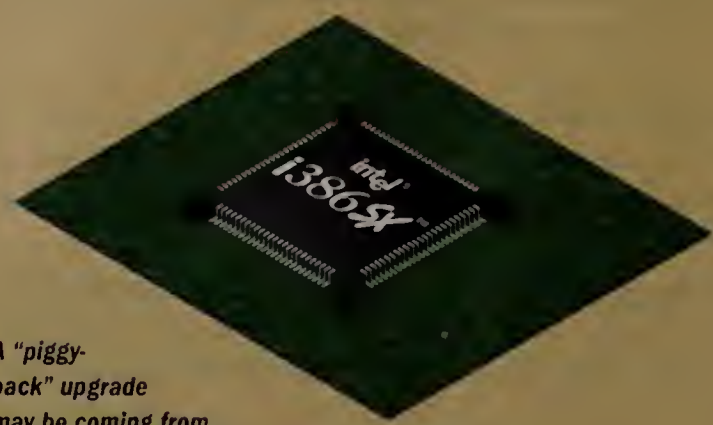
Chips for the Road

Mobile-PC users typically trade horsepower for long battery life and lower price. While some companies (notably Texas Instruments) have introduced notebook PCs based on the 486SX or 486DX, most vendors prefer 25-MHz versions of Intel's 386SL or AMD's 386SXL, both of which offer special features that conserve battery power. Cyrix's low-power 486SLC is also gaining acceptance.

PC World's tests show that these chips are equally adept at power management, but 386SL machines deliver a little more speed than 386SXL systems. The 386SL contains a controller for an external memory cache, saving precious notebook real estate and encouraging notebook designers to include a performance-enhancing cache. By contrast, few 386SXL notebooks have memory caches.

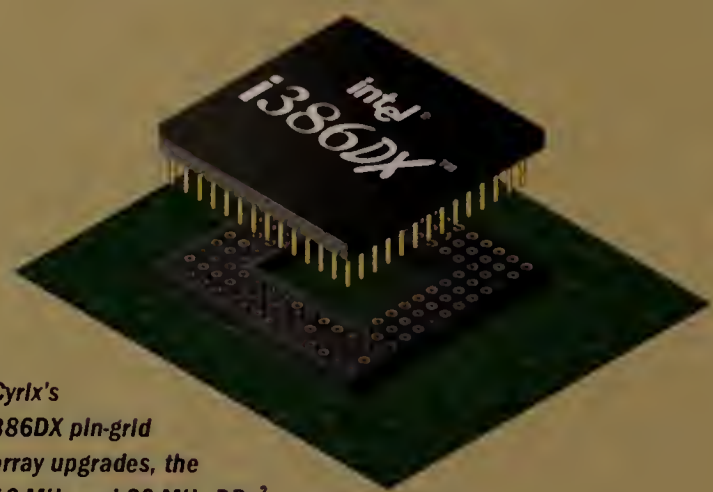
Is There a CPU Upgrade in Your Future?

Replacing your system's processor with a more powerful one is the most cost-effective way to enhance system performance. 486SX and late-model 486DX systems are designed for a chip-level upgrade, and soon you'll be able to beef up 386 and DX2 systems with chips from Cyrix, Intel, and possibly others.

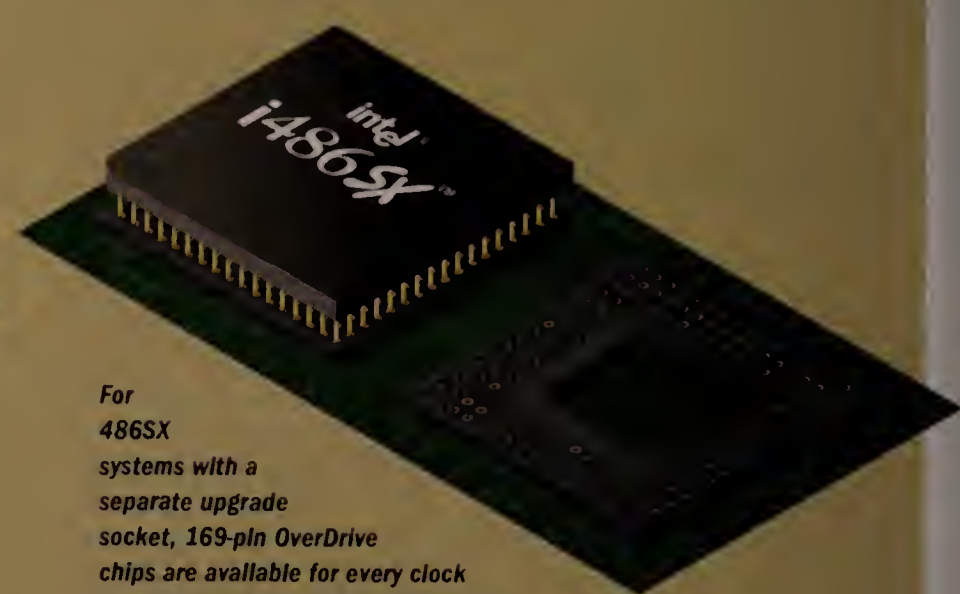


A "piggy-back" upgrade may be coming from Cyrix* in 1993 for the socketless, surface-mounted 386SX.

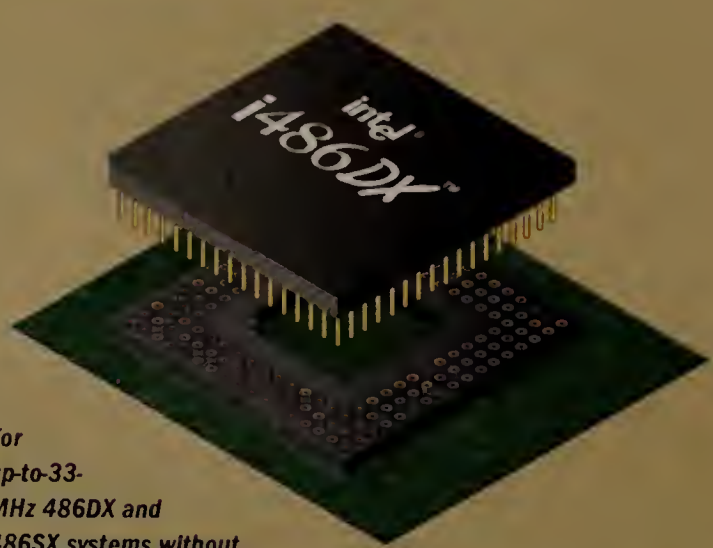
No one has announced an upgrade chip for CPUs designed to fit in leadless chip carriers (such as certain versions of the 386SX).



Cyrix's 386DX pin-grid array upgrades, the 16-MHz and 20-MHz DRu² and the 25-MHz and 33-MHz DRu, are available only to large accounts*, with end-user availability predicted for mid-1993. Cyrix is working on a DRu² for 25-MHz 386s.



For 486SX systems with a separate upgrade socket, 169-pin OverDrive chips are available for every clock speed. If you have an adjustable clock, set it to its highest speed not greater than 33 MHz and get an OverDrive to match.



For up-to-33-MHz 486DX and 486SX systems without the upgrade socket, pull out the CPU to see if the socket has 169 or 168 holes, set the system clock (if adjustable) to its highest speed not greater than 33 MHz, and buy a corresponding OverDrive.

Some 486DX2 systems have a large socket with pinholes that nearly surround the CPU. Sometime in late 1993 or early 1994, you'll be able to put a version of Intel's next-generation processor, or possibly an upgrade from another manufacturer, into that socket.

**Please do not call Cyrix. Large accounts should fax requests for information to Mike Bruzzone at Cyrix (214/699-9857).*

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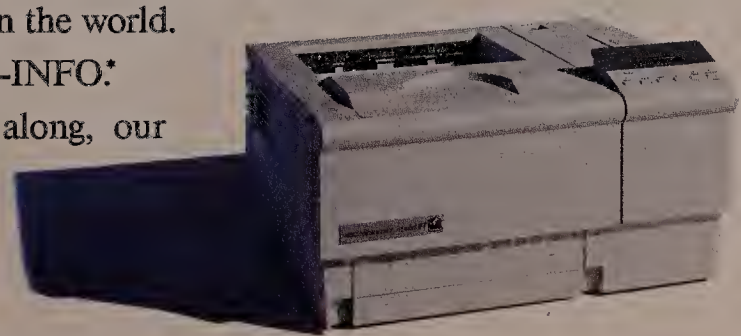

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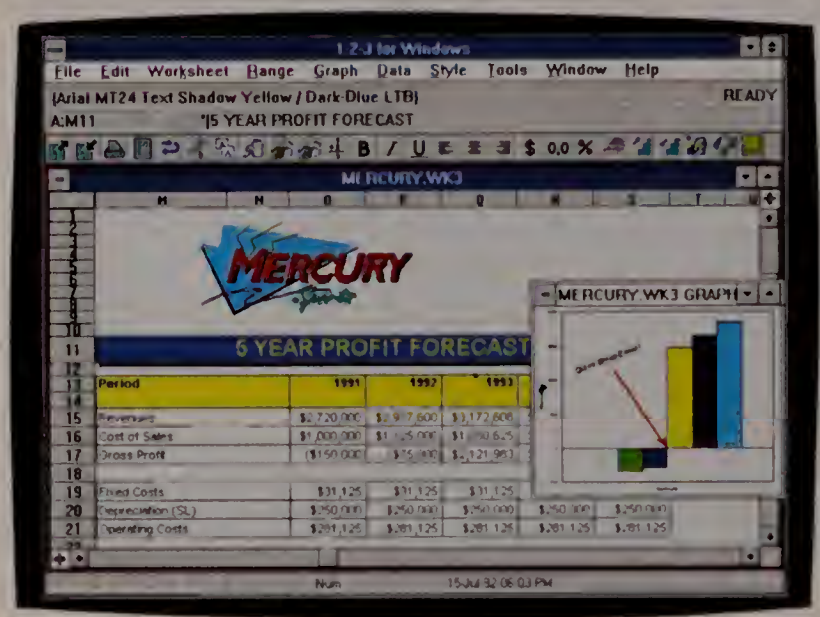

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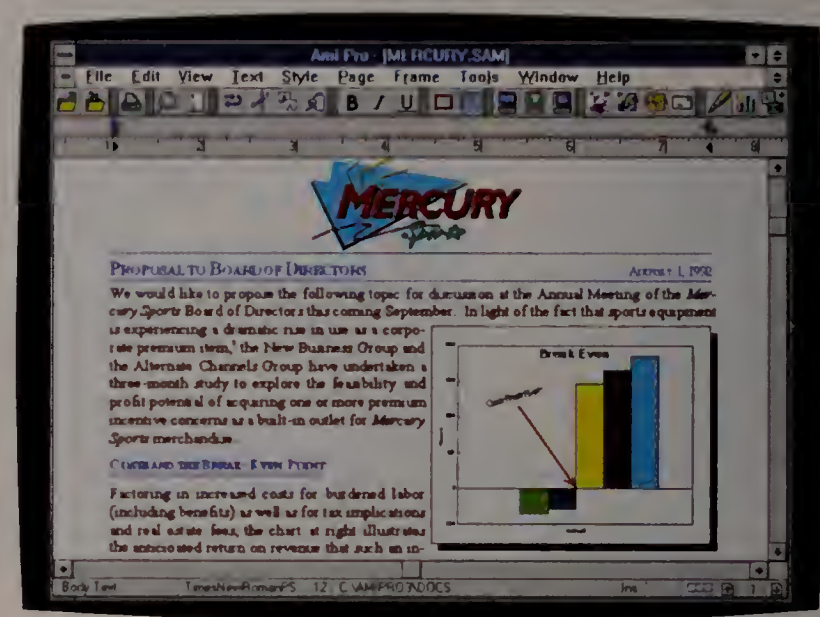

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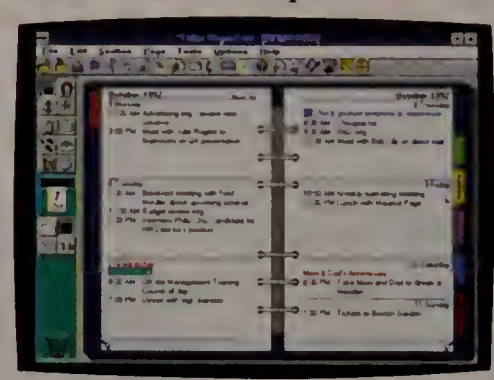

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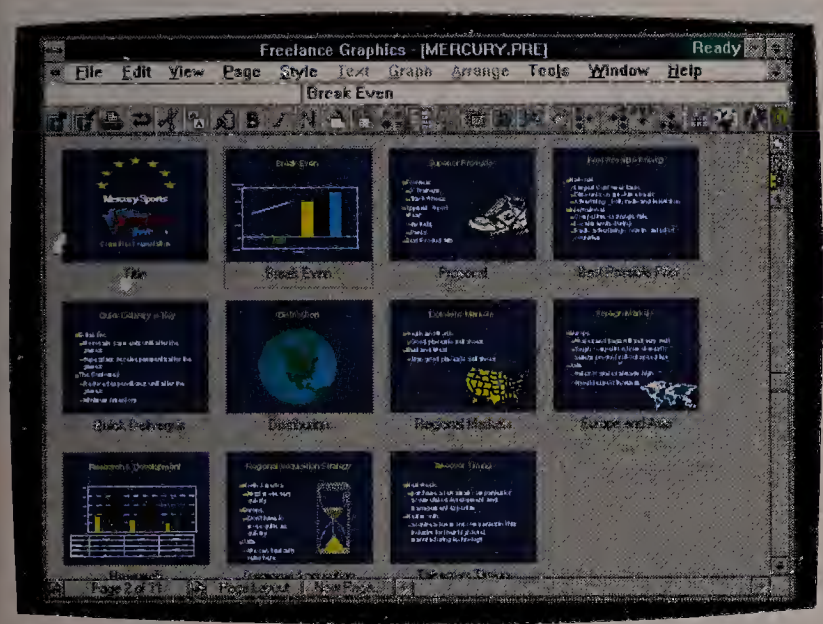

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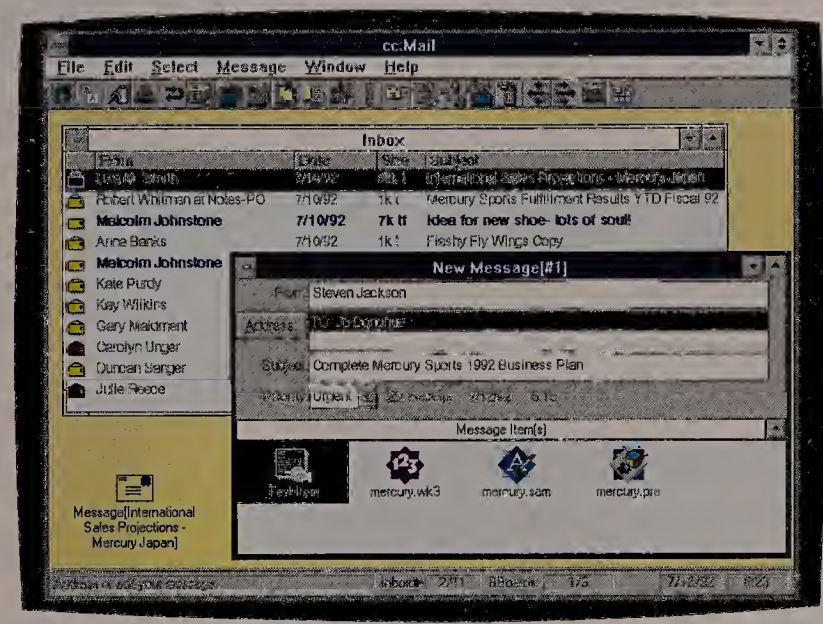

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Predictably, another new chip should soon stand the notebook world on its head. Last month Intel introduced the 486SL, which is basically a 25-MHz, low-power rendition of the 486DX. Amazingly, these chips draw even less power than their 386SL and SXL counterparts, so you can enjoy both double the computing horsepower *and* longer battery life at the same clock speed. (See the Test Drive of the first notebook based on Intel's 486SL chip in this month's *Top of the News*.)

Early next year the alluring features and potential of the 486SL should land this hot chip in hundreds of new notebooks. Unless your mobile computing needs have to be tended to immediately, you might want to wait until these machines arrive before you buy. Even if you don't need 486SL power, you can be sure the new 486SL notebooks will force down the price of existing 386SL and 386SXL notes.

Dawn of the P5 Era

Before getting down to the nitty-gritty of what to buy for your desktop, you need to know what the future holds, so you can decide whether to sit tight and wait for PCs with chips—or upgrade schemes—that promise the kind of useful life span usually associated with Toyotas. Here's what we know at press time.

Once again we're on the verge of a new era in computing, thanks to Intel's much-ballyhooed successor to the 486, code-named P5. Intel has been tight-lipped about this processor, though details should be revealed early next year. We do know that it will have more than 3 million transistors (nearly three times the number the 486 has), and that it will be *superscalar*—able to process more than one instruction per clock cycle. Two important things to know about this processor: It will offer yet another quantum leap in performance, and it won't fit into a 486 socket.

Once again we're on the verge of a new era in computing, thanks to Intel's much-ballyhooed successor to the 486, code-named P5.

However, an OverDrive version of the P5, which will have somewhat less capability than the genuine item, will plug into any 486 system that includes a special upgrade socket. PCs with this multipurpose socket have already begun to appear; an extra line of pinholes surrounding the 486 chip indicates a socket that also handles the P5-based OverDrive. Intel expects to release this upgrade chip in late 1993 or early 1994.

And what of the compatibles? At this writing, no rival company has released a processor that exceeds the power of Intel's 33-MHz 486DX. However, rumor has it that next year Cyrix will not only have a clock-doubling upgrade for 386s, but will also offer a high-performance version of the OverDrive chip for 486 systems. Moreover, Cyrix has its own secret weapon, dubbed the M1, which is intended to compete directly with the P5 and should be released sometime in 1993.

AMD was expected to release 486 compatibles this year, but it lost a court battle with Intel and was forced to return to the 486 drawing board. Nonetheless, AMD 486s are expected to arrive no later than 1993. As for IBM, the company's joint development agreement with Intel should foster extremely powerful chips that integrate all major motherboard functions on a single die, but no specific product plans have been announced as of press time. Chips and Technologies plans to continue its work on super-integrated, Intel-compatible CPUs for hand-held PCs.

Time to Place Your Bets

Intel's competitors will undoubtedly produce enough new chips to keep the pace breathless for years to come. How can you possibly decide what to buy amid this craziness? Consider the following desktop PC purchasing strategies:

Sit tight and wait for 386 upgrade chips. This is the low-risk, low-return plan. If you can live with your current 386 PC's performance for another six months or so, you can wait for Cyrix or others to come out with end-user upgrades.

The problem is, there's no guarantee a 386 upgrade processor will work with every machine, and given the performance of Cyrix's 486DLC, the speed boost won't necessarily thrill you. Nonetheless, if the upgrade chips prove to disappoint, rest assured that you'll be able to buy a brand-new, blazingly fast system for a pittance six months from now.

Sit tight and wait for the P5. The power-user option. People who need (or feel they deserve) top performance may wish to wait until P5 systems hit the street before buying a new PC. Mid-1993 is as good a guess as any for the on-sale date of P5 systems. These systems will cost a bundle—if history is any guide, at least 25 percent more than 66-MHz DX2 systems.

Buy now, and buy serious. This is the best choice for two reasons: a huge, recent drop in system prices, and lots of upgrade headroom. Almost everyone can now afford either a 33-MHz 486DX or a 66-MHz DX2 PC. We've already seen prices as cheap as $2500 for a fully configured DX2-66, which is an outrageously low figure for a PC equipped with the fastest processor available. (Usually, the price/performance "sweet spot" is one step back from the cutting edge.) If that figure still sounds too steep for you, you can find a lowball 33-MHz 486 system for $2000 and upgrade it with a 33/66-MHz OverDrive later (at press time, this chip's list price was $799). And if you can find a system with a P5-based OverDrive socket, you'll have a machine with more headroom than you'll be able to use over the next year or two.

Beyond this, who knows what else Intel and its competitors will come up with. Intel hasn't talked product yet, but its engineers see no theoretical barriers to OverDrive chips that *quadruple* internal processing, and common sense dictates that we'll see 100-MHz DX2s and 50/100-MHz OverDrives pretty soon. Rely on *PC World* to keep you abreast of the latest developments.

You can count on two things: Intel's competitors will continue to offer ingenious upgrade chips and CPU clones, and Intel itself won't cede an inch of its technological leadership. Competition may have put a dent in Intel's profit margins, but it also lit a fire under the world's most brilliant chip architects and engineers. That may make those PC buyers who need to keep up with the latest technology reluctant members of the chip-of-the-month club. But the benefit of that membership is unprecedented processing power at unheard-of prices.

Eric Knorr is editor of PC World. *He can be reached on PC World Online (see page 8 for more information).*

The Evolution of CAD

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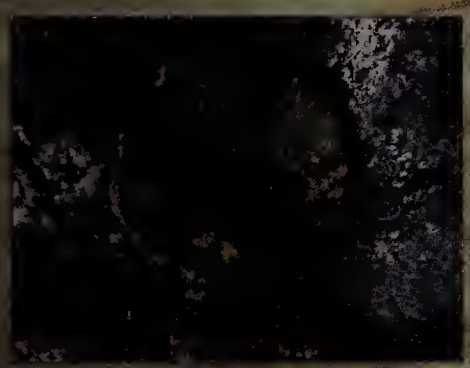

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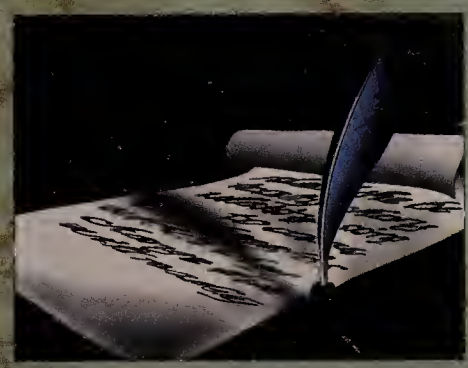

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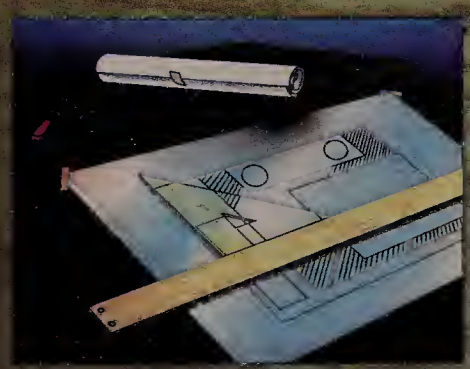

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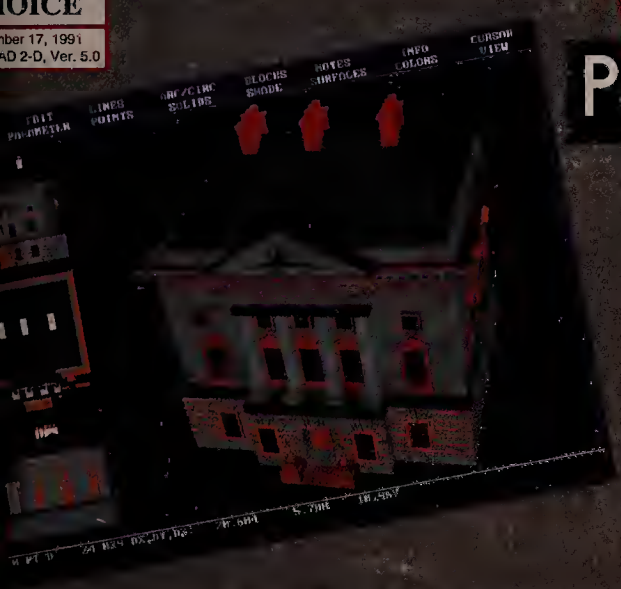

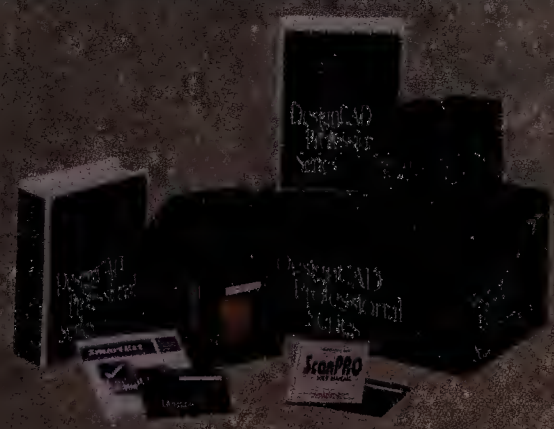

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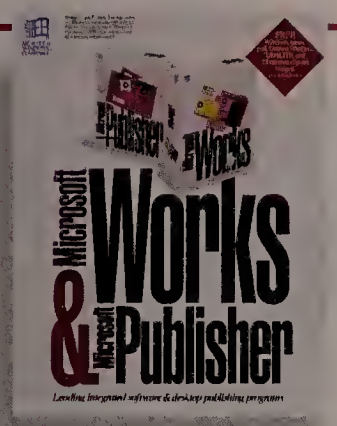

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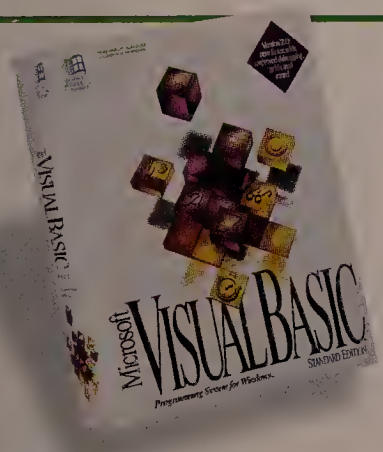

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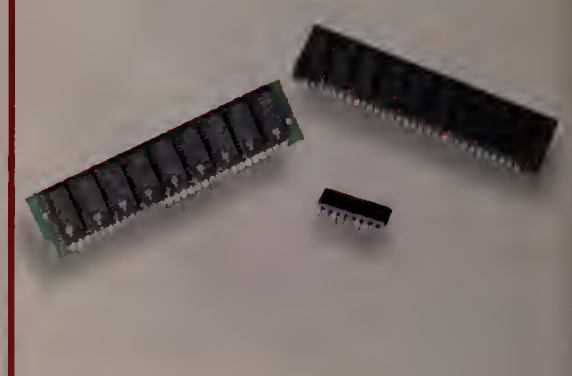

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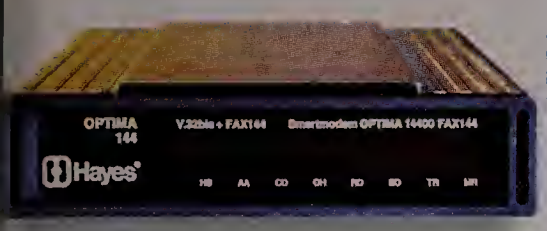

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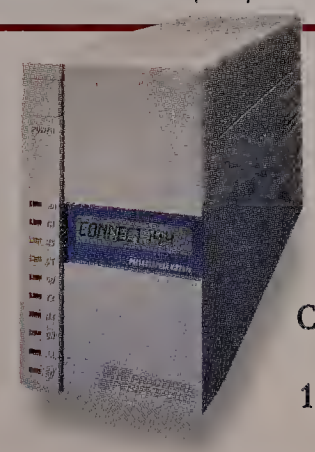

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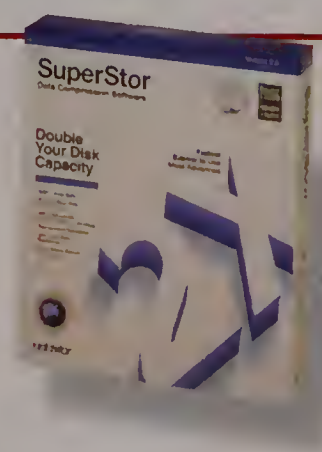

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Next-Generation Lasers

All of a sudden 600 dpi is the new standard. In this review, HP's LaserJet 4 defines the playing field as a new crop of high-res laser printers promise speed, high capacity, and typeset-quality output.

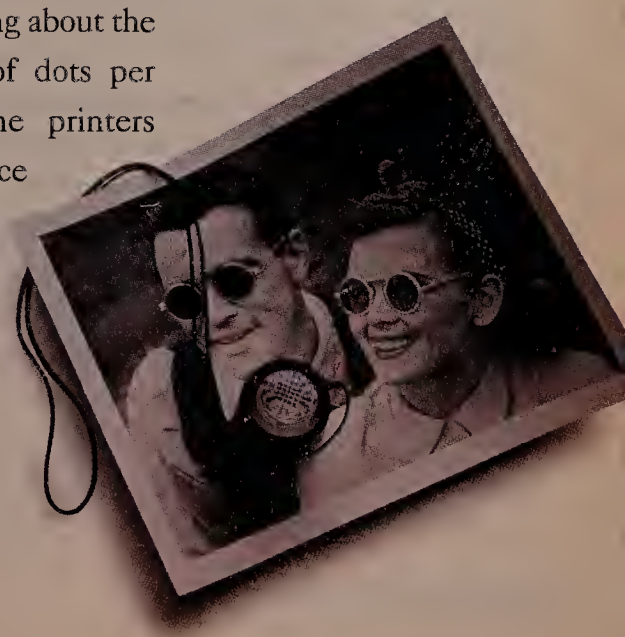
By Daniel Miles Kehoe

It's almost three years since Hewlett-Packard set the standard for print quality with the introduction of the LaserJet III, a 300-dot-per-inch (dpi) printer with Resolution Enhancement technology. Now HP does it again with the introduction of the LaserJet 4 and 4M printers, declaring 600 dpi the new standard for print quality.

Should you care? Yes, according to a panel of users convened to compare the print quality of the HP and other tested printers. 600-dpi quality is noticeably better than 300-dpi output—especially for graphics and halftones.

For this article, *PC World* looked in particular at the two new HP LaserJet 4s. Other 600-dpi printers we included are the NewGen Systems TurboPS/660, the IBM LaserPrinter 10P/Lexmark, and the Xante Accel-a-Writer 8000. We added the new Compaq Pagemarqs because of their improved 800-by-400-dpi resolution. We also looked at two LED-array printers from Kyocera and Okidata; they print documents at a 300 by 1200 resolution.

Despite printing about the same number of dots per square inch, the printers here run the price gamut, from the $1699 Okidata OL810 LED printer to the fast, network-primed $5499 Compaq Pagemarq 20. As our tests show, equivalent resolution doesn't translate into comparable output quality. In "Not to be Missed," we also take a look at newly announced 600-dpi printers from Calcomp, Dataproducts, and QMS that just missed our testing deadline. Our conclusion: While the HP LaserJet 4 offers real 600-dpi quality for the fewest bucks, many of the other printers offer distinguishing features.



The PC World Test Center subjected these laser printers to a battery of speed and compatibility tests. We then assembled a panel of judges—both experienced laser printer users and graphic artists—to cast a discerning eye on the resulting output. In the overall evaluation, print quality was of prime importance, followed by performance and price. We also rated paper-handling features, font and emulation options, quality of design and construction, and manufacturers' service-and-support policies.

Looking Sharp

Standard office laser printers currently use a 300-dpi engine. Most improve output by using clever technological tricks, crowding some extra dots in to improve overall resolution. In this review, the NewGen has effectively uprated its 400-dpi engine to 600 dpi using an advanced controller board, while the Xante's basic 300-dpi engine is dramatically enhanced to reach 600-dpi output.

The Okidata and the Kyocera place dots using LED arrays rather than a laser beam, and they can place additional dots vertically on the page between the regular 300-dpi positions while the paper drum is advancing. The result is accurate placement and sizing of four times as many rows of dots as the printer engine alone could manage. In contrast, the Compaq uses an 800-by-400-dpi engine.

True 600-dpi printers, which make up the remainder of our printers, are designed to place 600 dots per inch accurately on the page. The HPs add resolution enhancement to improve on that, while the Lexmark sticks with straight 600-dpi output.

Enhanced-resolution 300-dpi printers are generally less expensive but don't deliver the overall print quality of true 600-dpi printers. Our tests bear this out, with the HP printers coming out on top. The Lexmark doesn't do as well, perhaps because it lacks resolution enhancement at 600 dpi. The Xante finished just behind the HP, thanks to advanced enhancement technology that Xante claims gives its printer a resolution equivalent to a true 600-dpi printer's.

Enhanced-resolution 300-dpi printers are generally less expensive but don't deliver the overall print quality of true 600-dpi printers. Our tests bear this out, with the HP printers coming out on top.

You won't see as many differences on text output between resolution-enhanced and true higher-resolution printers. Scanned images and graphics in general look remarkably better when printed at 600 dpi, but only if they were originally created at high resolution.

Looking at Performance

Print speeds vary widely from printer to printer and from job to job. A printer never runs faster than its rated engine speed; more often, it slows as the processor maps fonts and rasterizes images. Faster processors, like the AMD 29000 in the Compaq or the Weitek 8220 in the NewGen, can let a printer continue to run at its rated engine speed even when printing complex graphics. Pick a fast 15- or 20-page-per-minute (ppm) printer for network use—here, the Compaq printers—or an 8-ppm printer for use by one to three people.

The interface between computer and printer can limit printer performance, as can application software drivers. A direct ethernet or token ring network connection transfers data to the printer more quickly than a parallel connection to a print server. Most manufacturers support direct interfaces to Novell NetWare—*Microsoft LAN Manager*, TCP/IP, or Apple EtherTalk may be options. Only NewGen Systems offers a direct interface that recognizes all common network protocols.

Best Buys

The Hewlett-Packard LaserJet 4 is clearly setting a new standard in price and output quality. When the LaserJet III came out it was an immediate best-seller, but the increase in output quality over a LaserJet II was not as great as that of a LaserJet 4 over a LaserJet III.

The Compaq Pagemarq 20 breaks new ground in several ways. It's beautifully designed to fulfill the needs of network laser printer users: The quality of output is good, the performance excellent, and the price, while steep for a desktop, very good for a network laser printer.

Hewlett-Packard LaserJet 4

Compaq Pagemarq 20

The Price Is Right

High-resolution printers were once high-priced printers. Not so anymore. While *PC World* was unable to survey street prices of several of the newest printers, it's likely that the Best Buy HP LaserJet 4 will sell for the same street price as the LaserJet III it replaces—about $1700. Expect to pay at least twice that for a network printer such as the Compaq Pagemarq 20. Factor in the cost of consumables, such as toner and paper, over the life of the printer and watch the price change—the NewGen Systems TurboPS/660 will become the most expensive printer, and the Kyocera Ecosys a-Si the cheapest. Other options, such as a direct network connection or extra paper trays, may require an additional outlay. With the exception of the Okidata OL810 and the Kyocera, the printers we examined have enough RAM to produce a full page of 600-dpi graphics.

Gauging Service and Support

The manufacturers of the reviewed printers back their products with one-year warranties—some with on-site service, some with service through a dealer. Check your dealer's policies if you won't be getting on-site service. Compaq provides free on-site service for its Pagemarq printers, which is a great plus. Engine duty cycle ratings will help you gauge the likelihood of future service needs. Page-per-month ratings indicate how much you can expect to print while still enjoying trouble-free operation. Network printer users will need this figure to be much higher.

Design and Construction

Among printers, ease of use is the hallmark of good design. You should look for understandable and easily visible front-panel con-

trols, printer utility software, automatic port switching, and integrated toner-drum cartridges that aren't complicated to change. Other construction pluses are a small footprint, low weight, the absence of small plastic parts that might break easily, and simple setup procedures. The Compaq, the Lexmark, and the HPs stood out in design and construction. The Compaq also introduced several novel features, including motorized paper trays and a fax-modem option, and had excellent ease of use. The Kyocera stood out for its reduction of running costs through the use of new technology and design.

Emulation sensing, or automatic language switching, proved to be a problem with all but one of the reviewed printers. Emulation sensing—the capability to switch a printer between PostScript and PCL modes—is essential with a network, especially when a mix of software is used or when users are accustomed to reaching for the <Print Screen> key. Only the Compaq Pagemarq 20 could always switch accurately between PostScript and PCL modes with our test suite of common applications in a network environment.

Best Output

These two printers produce excellent output on both text and graphics. Our panel of judges rated them noticeably higher than the other printers in this review, and they scored particularly well on graphics. Both take advantage of resolution enhancement to improve the images they produce. Both also dramatically improve print quality for halftone and photographic images. The Xante's output quality is especially noteworthy because of its basic 300-dpi engine. Xante intends to bring out a new model, the Accel-a-Writer 8100, that uses the same technology as the 8000, has a true 600-dpi print engine for a claimed resolution of up to 900 dpi, and costs $3995.

Hewlett-Packard LaserJet 4

Xante Accel-a-Writer 8000

Font/Graphics Options

These days it's easy to add scalable typefaces to *Windows*, either in TrueType format or PostScript Type 1 format (with the addition of *Adobe Type Manager*). All the printers reviewed contain scalable typefaces. You'll experience faster printing if you choose the typefaces resident in the printer.

The HP LaserJet 4 contains a type rasterizer for both Intellifont and TrueType typefaces. This makes it a good match for *Windows* users who have a TrueType typeface library, because TrueType fonts will print faster as a result.

To speed access to typefaces, the NewGen Systems TurboPS/660 can support its own hard drive for storing commonly accessed PostScript typefaces; the Xante Accel-a-Writer 8000 contains its own flash ROM for user-stored typefaces and a hard disk port; and Compaq offers an internal hard disk and a unique programmable font card for the Pagemarq printers. Any of these solutions lets you adopt a standard typeface for convenient and regular use.

Printers with PCL 5 or PostScript Level 2 (all but the Lexmark, the NewGen, and the Xante) are able to receive graphics data from the computer in compressed format, which speeds printing compared with PostScript Level 1 or PCL 4.

HP is doing a remarkable job of pushing the price/performance boundaries for printers, and its track record in innovation is hard for other manufacturers to match. Nevertheless, some of them have.

The Paper Trail

Envelopes have long been the bane of laser printers' existence. A few manufacturers, such as Lexmark, have devoted considerable attention to accommodating envelopes, but we recommend testing a printer with your own office envelopes before making a purchase.

Many printers accommodate legal-size sheets and other odd sizes through a multipurpose tray, but it's inconvenient to keep switching paper and trays. Look for a printer that holds more than one size at once. The Kyocera, NewGen, Okidata, and Xante come with only one tray, but you can add more to the Kyocera and Okidata.

Among the reviewed printers, only the Compaq Pagemarqs include 11-by-17-inch printing standard, a welcome feature for those who print posters, presentations, and spreadsheets as well as large engineering drawings.

Network use demands maximal paper capacity, and even a single user will experience greater productivity when paper refills are few and far between. A 250-sheet tray is adequate. Consider purchasing optional paper trays both for increased paper capacity and for the luxury of mixing letterhead and second sheets for office correspondence. Check that the printer driver for your software supports a choice of paper trays.

The bottom line? The HP LaserJet 4 emerged as a Best Buy, with a combination of price, print quality, and ease-of-use benefits. It sets 600 dpi as the new base standard for desktop laser printing, supplanting the best-selling HP LaserJet III at a lower price level but with improved features and print quality. HP is doing a remarkable job of pushing the price/performance boundaries for printers, and its track record in innovation is hard for other manufacturers to match. Nevertheless, some of them have. A Best Buy also goes to the Compaq Pagemarq 20, which sets new standards for network printers in paper handling, network connections, and performance.

The Okidata still stands out on price—you should be able to buy it for around $1000 on the street. Once other manufacturers react to HP's aggressive strategy, however, it will face some competition. The Kyocera sets some new standards for durability and operating cost that should eventually find their way into other laser printers.

Our advice: 600 dpi is the next generation for desktop laser printing—remember that when you go shopping.

Daniel Miles Kehoe regularly writes about laser printers for PC World. *He is a contributing editor for* NeXTworld *magazine.*

For more information about all products in this article, circle reader service no. 905.

VITAL STATISTICS

List price: Pagemarq 20 $5499, 15 $3999

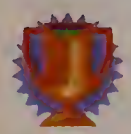
PROS: Very fast, durable, large paper capacity, fax option

CONS: High cost, large size

Contact: 800/345-1518

Reader service no. 757

Compaq Pagemarq 20, Compaq Pagemarq 15



It's an uneven contest between the high-capacity, heavy-duty Compaq Pagemarq 20 and the other printers reviewed here. Aside from the $5499 price tag, the other printers come up short—in features and in performance.

The Pagemarq 20 is a network printer, with 20-ppm speed, a 50,000-page-per-month duty cycle, and a 1500-sheet paper capacity right out of the box. It offers a direct network interface as an option—$599 for ethernet, $799 for token ring—to accommodate the busiest office networks. Emulation sensing handles both PostScript Level 2 and PCL 5 print jobs without a misstep—an essential feature in a network environment where users send both types. In our tests, the Pagemarq was the only printer that could do this. Moreover, benchmarks showed it to be by far the fastest printer on both text and graphics, especially for long documents, where its 20-ppm engine outdistanced all competitors.

The fact that it's a workhorse doesn't mean the output's ugly: Our judges scored the Pagemarq 20 among the top three printers for overall output quality. The Pagemarq 20's Fuji Xerox engine is capable of 400 dpi in the vertical axis and can be driven to 800 dpi along the horizontal axis in its PostScript mode (PCL 5 output is limited to 300 dpi).

The Pagemarq 20 has unusual motorized trays that are slightly larger than 11 by 17 inches. The three trays can each accommodate two side-by-side stacks of 250 sheets of 8½-by-11-inch paper, for a total of 1500 sheets. As one stack empties, the second stack slides

Looking Sharp: 600-DPI Output Is a Clear Winner

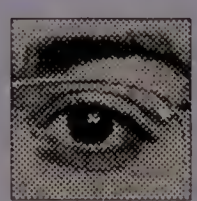
Compaq

The Compaq text is crisp and clear with little spotting or blurring, but you can see pixels on the curves within characters. Graphics output is good, but 800 by 400 dpi isn't as good as 600 by 600 dpi, although it's far superior to enhanced 300 dpi.

Hewlett-Packard

The HP LaserJet 4 prints text superbly. There is nothing to find fault with. Graphics show off the HP's output superiority clearly. It produced the best graphic output of any printer here.

IBM/Lexmark



The IBM LaserPrinter 10P/Lexmark has clear, crisp text and good blacks. There is a small stairstep on diagonals and curves. Graphics output is decent, showing the benefit of 600 dpi, even without further resolution enhancement.

Kyocera

The Kyocera has the worst text, with breaks on diagonals and curves within characters. The characters look broken. While superior to 300 dpi, the graphics quality isn't as good as that of the other printers, except the similar Okidata.

NewGen

The NewGen has very strong blacks—a design goal of the printer—and excellent, clear text, although some of the character serifs are faint. This graphic output is a perfect example of the problem our output quality panel had with the NewGen. While resolution is good, the output is too dark to pass muster.

Okidata

The Okidata has noticeable steps on diagonals and curves, and individual characters seem to have different weights on different horizontal or vertical strokes. Like the Kyocera, the Okidata's 300-by-1200-dpi output can't match real 600-dpi output. In addition, we had a slight banding problem on our halftone output.

Xante

The Xante has good blacks and clear, crisp text. Some of the characters appear to have slightly inconsistent weights. Graphics output is very good, especially in lighter areas. Xante claims to have quality equivalent to 850 dpi, but that doesn't hold up under careful scouting.

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into place. Interestingly, this is the first of a new breed of printer that accommodates 11-by-17-inch pages as a standard feature. No one will complain that this printer can't do the job, even if that job is a huge spreadsheet or poster.

The Pagemarq 20 has the best ease-of-use features among all the reviewed printers. A control panel springs out with a touch, revealing a two-line, 32-character display and a help button that prints a map of the control panel's menus. Direct network connections are limited to Novell and AppleTalk—support for TCP/IP, *LAN Manager*, and Apple EtherTalk protocols may come next year.

The Pagemarq 15, the 20's little cousin, matches it step-by-step, with three exceptions: Engine speed is only 15 ppm, standard paper capacity is only 750 sheets, and the price is only $3999. The Compaq Pagemarqs are the first printers we've seen that accommodate the range of real office needs—network speed for text and graphics, large format output, and integrated faxing—at a realistic price.

VITAL STATISTICS
List price: LaserJet 4 $2199, 4M $2999
PROS: Top print quality, excellent value
CONS: Average speed
Contact: 800/752-0900
Reader service no.758

Hewlett-Packard LaserJet 4, Hewlett-Packard LaserJet 4M

Hewlett-Packard's $2199 8-ppm LaserJet 4 and the $2999 LaserJet 4M, a PostScript printer, are the standard-bearers of a new generation of laser printers. Other manufacturers have staked out 600-dpi turf, but HP and Canon (manufacturer of the P-270 engine) have gone all out to design these 600-dpi printers from the ground up. Canon's optical engineering, combined with improved toner and HP's Resolution Enhancement technology, lays claim to a new standard in print quality. *PC World*'s judges agree: The new LaserJets produce the best output of the printers reviewed.

The PC World Test Center's benchmarks give the LaserJet 4 medium speed when it comes to graphics-intensive pages. In PostScript mode, its cousin, the PostScript-based LaserJet 4M, runs slightly slower on the first pages out and faster on subsequent pages, neatly bracketing the printer's PCL 5 performance. The differences between the printers are that the 4M includes PostScript Level 2, comes with more base memory (6MB rather than 2MB), and has an AppleTalk interface.

Ease of use has been raised to a new level. There's still a convenient integrated toner cartridge, but its capacity has increased to 6000 pages. A power switch is now up front—easy to reach without stretching. A tiny indicator bar shows how much paper remains. The control panel is a bright vacuum-fluorescent display. New PC utility software offers a tour of the printer's features plus PC-based control of the printer's functions. There's only one slot for a font cartridge, but with 35 scalable Adobe typefaces on the LaserJet 4M and a choice of 35 scalable Intellifont typefaces plus 10 scalable TrueType faces on the LaserJet 4, who cares?

Hewlett-Packard's $2199 8-ppm LaserJet 4 and the $2999 LaserJet 4M, a PostScript printer, are the standard-bearers of a new generation of laser printers.

Both printers take up less space than the LaserJet III, partly because no paper trays hang off the front. The printers' cartridge and laser scanning modules are mounted on the engine's frame, rather than on a clamshell door, providing greater stability for the laser. The standard 250-sheet letter-size tray is now underneath the printer (an optional 500-sheet tray can be stacked below). A multipurpose 100-sheet tray unfolds at a touch from the front of the printer. With maximum paper capacity limited to 850 sheets, these printers are not intended for heavy network use, although it's possible to share the LaserJet 4 and LaserJet 4M in small work groups—though the LaserJet 4's and 4M's emulation sensing failed our most rigorous tests.

The LaserJet 4 earns a Best Buy for extraordinary print quality at a bargain price. The LaserJet 4M deserves accolades for print quality, but at $2999, it's no bargain. If you don't need an AppleTalk port, you can buy the LaserJet 4 and add PostScript for $495 (list)—our recommendation for the best PC-ready PostScript value.

VITAL STATISTICS
List price: $3795
PROS: Careful attention to ease of use
CONS: Average print quality, slow
Contact: 800/358-5835
Reader service no. 760

IBM LaserPrinter 10P/Lexmark

Over the last three years, Lexmark has introduced half a dozen printers built on the same basic chassis. The nomenclature has been confusing, but the features of its newest, the $3795 IBM LaserPrinter 10P/Lexmark (or Model 4029-042), stand out. It's a PostScript printer, and one of the first to deliver 600-dpi quality.

Lexmark has worked hard to assure ease of use. The printer unpacks quickly, with a high-capacity toner cartridge already installed. An improved control panel displays large, bright, scrollable messages. There are 39 built-in Adobe Type 1 typefaces with matching screen fonts available for *Windows*. A 250-sheet output tray signals when it's full, and an input paper tray automatically senses the

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  High resolutions up to 1280 x 1024 add to image sharpness and increase the amount of information on Windows.

- **FULL SCREEN DISPLAY**
  The simple adjustment of external controls results in a Full Screen Display — eliminating dark margins around the image. This ability is a tremendous advantage in Graphics User Interface and Multimedia applications.

- **FLAT-SQUARE SCREEN**
  CTX large screen models (CPS-1560 & 1760) are manufactured with flat-square picture tubes for CAD/CAM and imaging applications. This increases display clarity while reducing image distortion and screen glare.

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  CTX Professional Series features digital controls which allow for easy adjustment of picture size and position. With 15 memory channels preset to the most common video standards, these monitors adapt quickly to a wide range of video cards. The Multiscan Series (CMS) provides up-front knobs for screen adjustment while retaining all other advanced features of CPS models.

- **LOW RADIATION (MPR II)**
  Low Radiation models are available for additional protection against electromagnetic radiation emitted by all CRT's during normal use.

Model	5468A	5468NI	CPS-1460	CPS-1560	CPS-1760
Scan H: Freq. V:	30-38KHz 50-90Hz	30-50KHz 50-90Hz	30-60KHz 50-90Hz	30-60KHz 50-90Hz	30-65KHz 50-90Hz
Resolution (Max.)	1024×768 /43.5Hz	1024×768 /60Hz	1024×768 /70Hz	1024×768 /70Hz	1280×1024 /60Hz

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Circle 59 on reader service card

size of the paper placed in it. A patented pressure roller handles envelopes without creasing them. The sum total is a printer that's user-friendly.

Unfortunately, the LaserPrinter 10P illustrates that not every 600-dpi printer produces top-notch output. *PC World*'s judges declared that the printer's output closely matched the quality of 300-by-1200-dpi printers such as the Kyocera Ecosys a-Si or the similar Okidata OL810. Nor was it a winner in performance tests. It scored well on long documents, but on shorter documents and complex graphics pages, it lagged behind all the printers here except the Xante Accel-a-Writer 8000. For $3795, you'll be able to find a better buy elsewhere.

VITAL STATISTICS

List price: $2395
PROS: Compact, good paper handling, low operating cost
CONS: Average speed, mediocre print quality
Contact: 800/621-6777, 800/232-6767
Reader service no. 759

Kyocera Ecosys a-Si

The $2395 Kyocera Ecosys a-Si is the least expensive printer we reviewed, if you factor in the lifetime cost of consumables. Unlike any printer we've seen, the Ecosys a-Si has a built-in imaging drum that never needs to be replaced. That means you'll add only powdered toner—for less than 1 cent per page, compared with about 3 cents per page for consumables for typical laser printers. And the toner cartridges are biodegradable, hence the printer's name.

The 10-ppm Ecosys a-Si is an LED-array printer. It takes advantage of a high-frequency LED array to achieve 300-by-1200-dpi resolution from a 300-dpi engine. In effect, the Kyocera is able to print an extra three lines vertically while the printer drum advances. The Okidata printer reviewed here uses the same printing technique. Unfortunately, the horizontal limitation of 300 dpi is detectable to the eyes of the end user—*PC World*'s panel of judges rated the Kyocera's 300-by-1200-dpi print quality average. Performance ranking put the printer in the middle of the pack.

The Ecosys a-Si is the most compact of the printers here. However, this infant can grow to 4 feet in height with the addition of stackable paper-handling options such as two additional 500-sheet paper drawers, a duplex-printing module, a 15-bin sorter/mailbox, and a 70-envelope power feeder. Combined with an optional direct network interface card for ethernet or token ring, and a 30,000-page-per-month duty cycle, this printer is ready for any network.

Programmers can easily customize the printer's behavior by taking advantage of built-in bar codes and slots for two programmable IC cards. They'll store forms, logos, signatures, and other special-purpose graphics. With these special capabilities, this printer is well suited for use in manufacturing or similar production environments. However, it doesn't measure up on print quality to the Hewlett-Packard, Xante, and Compaq models.

VITAL STATISTICS

List price: $3495
PROS: Emulation upgrades, network protocols
CONS: Dark output, high price
Contact: 800/756-0556, 714/641-8600
Reader service no.761

NewGen Systems TurboPS/660

The $3495 NewGen Systems TurboPS/660 looks like the HP LaserJet Series II. Inside it uses a 400-dpi version of the familiar Canon LBP-SX engine but drives it to 600-by-600-dpi resolution using NewGen's own controller.

A SCSI port lets you add an external hard disk to store a user-supplied typeface library. Optional printer emulations such as Epson LQ-800 can be permanently downloaded to the controller, allowing NewGen Systems to offer future upgrades (such as a PostScript Level 2 mode). The optional ethernet interface card is unique, enabling the printer to simultaneously accept Novell, TCP/IP, and Apple EtherTalk protocols across the same network. However, the printer accommodates only 200 sheets of letter-size paper, with a 200-sheet legal-size tray as an option. No additional capacity can be added without cumbersome third-party equipment.

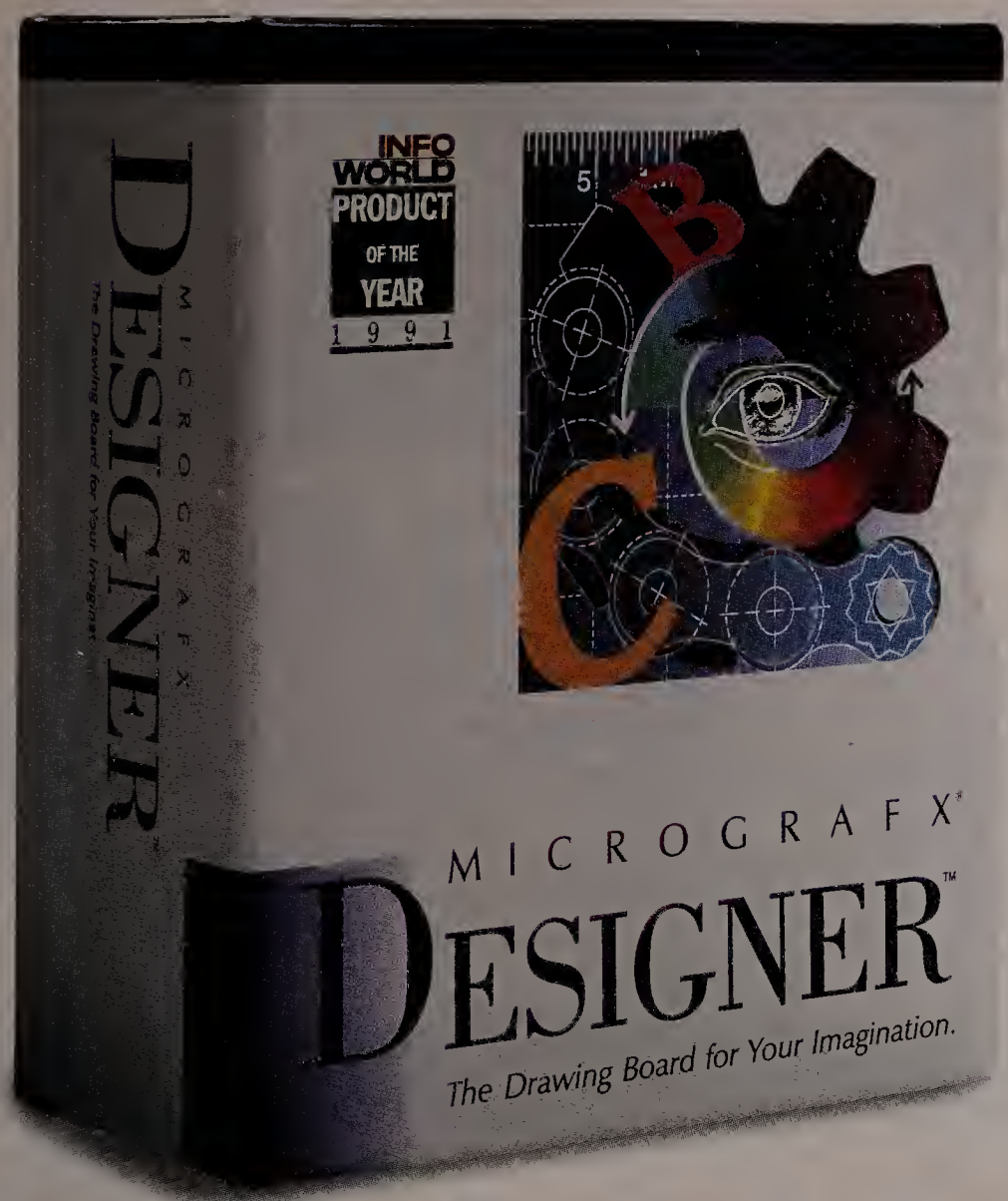
Speed was unexceptional. *PC World*'s panel of judges uniformly disliked the TurboPS/660's output. All pages appeared too dark, even when toner cartridges were changed and a print density control was adjusted to its lightest setting. In the panel's judgment, the output quality of the TurboPS/660 was the worst of the printers reviewed. We called NewGen and were told, "NewGen has a richer black than other manufacturers' printers." While *PC World* can't be certain that the unit we reviewed was typical, we advise you to thoroughly evaluate this printer's output before making a purchase.

VITAL STATISTICS

List price: $1699
PROS: Low price
CONS: Average speed and output quality, inadequate memory for graphics
Contact: 800/654-3282
Reader service no. 762

Okidata OL810

At $1699, this is the lowest-priced printer in the group. For the money, the Okidata OL810 is extraordinary. The printer's 300-by-1200-dpi output, enhanced by Okidata's own Smoothing Technology, scored only somewhat better than the worst-rated NewGen Sys-



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Dimensioning	Yes	No
Object snap	Yes	No
Maximum drawing size	132"×132"	17"×17"
Edit in full color	Yes	No
Clip art images	Over 1,700	750
Type 1 fonts	180	0
PageMaker 4.0 filter	Yes	No
On line help screens	Yes	No
24-hour support	Yes	No

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Designer system requirements: 286 (386 recommended) IBM PC or compatible, or PS/2. 1 MB RAM (2 MB RAM recommended). 20 MB (or larger) hard disk. Windows 3.0. DOS 3.1 (or higher). Mouse or digitizing pad. Windows-compatible monitor.

Circle 183 on reader service card

tems TurboPS/660's, but it compares favorably to the output of other printers in its price class.

The 8-ppm Okidata OL810's performance was good for such a low-priced printer, with adequate speed on both text and graphics. Its standard 1MB memory limits graphics to less than a full page, however, so purchase of Okidata's proprietary memory expansion module is de rigueur. An optional paper-handling mechanism, which accommodates an optional 200-sheet paper tray, supplements the supplied 200-sheet paper tray. Toner and imaging drum are separate components—potentially messy—but our lab staff had no problem installing Okidata's consumables. We experienced only one problem with our evaluation unit—its power supply failed after several days of use. This would ordinarily be corrected under the terms of a one-year warranty, though it would require returning the printer to a dealer.

Thirteen scalable Intellifont typefaces are identical to those standard in the HP LaserJet III, with three scalable font cards as an option. A PostScript option is promised for the end of the year. In the meantime, the Okidata OL810 masquerades well as an HP LaserJet III, with IBM Proprinter and Okidata OL400 emulations for older DOS applications.

The Okidata OL810 is a low-cost printer and a good value. Though it lacks the bells and whistles and the print quality of more expensive printers, it'll make your business look good on a budget.

VITAL STATISTICS

List price: $3295
PROS: Attractive output, font flexibility
CONS: Limited paper handling, slow
Contact: 800/926-8839
Reader service no. 763

Xante Accel-a-Writer 8000

The $3295 Xante Accel-a-Writer 8000 matches an advanced controller with the familiar Canon LBP-SX engine used by the HP LaserJet Series II.

PC World's panel of judges agreed that the output of the Accel-a-Writer 8000 was second only to that of the HP LaserJet 4. Besides 600-by-600-dpi text and line art, Xante claims the equivalent of 850-by-850-dpi quality for photos or gray-scale art. But beauty comes at a price, both in dollars and in the time it takes to print—the Accel-a-Writer 8000 was one of the slowest of the tested print-

Not to Be Missed: The Rest of the New Crop

By the time you read this, you'll have a wide range of new printers to choose from, among them the Calcomp CCL 600, Dataproducts LZR 965, NewGen Systems TurboPS/660 B, and QMS 860 Print System.

Three of these printers—from Calcomp, NewGen Systems, and QMS—use a new Canon engine, the LBP-BX, a sibling of the Canon P-270 used in the Hewlett-Packard LaserJet 4 and 4M printers. The base resolution of the new printers is 600 by 600 dpi—without any gimmicks. The P-270 engine in Hewlett-Packard's printers is limited to legal-size paper, while the more expensive printers from Calcomp, NewGen Systems, and QMS can print on 11-by-17-inch paper.

Calcomp

The $4495 Calcomp CCL 600 uses a PostScript-compatible Microsoft TrueImage page description language, with 35 native TrueType typefaces for accurate printing from *Windows 3.1* or Apple System 7. But it's the controller design that's most innovative. Calcomp pairs a fast Intel I960 RISC processor with the brand-new Intel 82961KA printer coprocessor, which takes over the most compute-intensive graphics tasks, accelerating page processing. It also reduces memory requirements to only 2MB. As other manufacturers adopt similar controller technologies, expect to see dramatic performance gains at plummeting street prices.

NewGen

In contrast, the $5495 NewGen Systems TurboPS/660 B requires a standard 12MB of memory in order to image an 11-by-17-inch page at 600 dpi. NewGen Systems includes a resolution enhancement technology that sharpens text and line art beyond 600 dpi. NewGen Systems' most interesting addition is a direct ethernet connection that simultaneously accepts data packaged in Novell NetWare, TCP/IP, or Apple EtherTalk protocols. It's the only printer that directly accommodates Novell PCs, Sun and NeXT workstations, and Macintoshes on the same network.

QMS

The $4595 QMS 860 Print System also needs 12MB of standard memory to achieve 600 dpi. QMS advertises emulation sensing, between QMS's own PostScript Level 1 and Level 2 clones, PCL 4, and HP-GL modes, preserving downloaded fonts while switching modes. An optional ethernet interface can be configured for NetWare, EtherTalk, or TCP/IP. There's a token ring interface for NetWare too. All ports are active, with buffers that receive data without pause.

Dataproducts

The $3495 Dataproducts LZR 965 is a horse of a different color: It matches genuine Adobe PostScript Level 2 and PCL 4 with a Sharp JX9500 print engine that's been boosted to 600 dpi. The engine is much more compact, handling fewer sheets (250 compared with 350 on the Canon LBP-BX) and without 11-by-17-inch format.

Don't expect the recent flurry of printer announcements to abate; there are many printer manufacturers adopting the new Canon engines or countering with their own 600-dpi products in the coming months. *PC World* will take a closer look at this field in future issues.

—Daniel Miles Kehoe

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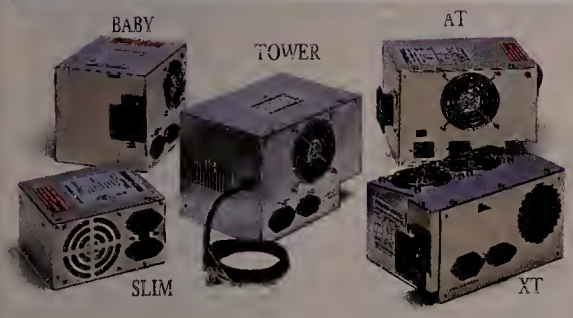

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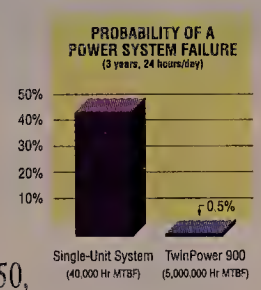
REDUNDANT POWER SYSTEM

Eliminate the risk of costly downtime or data loss due to power supply failure with the TwinPower 900 Redundant Power System. The TP900 consists of two Turbo-Cool 450 power supplies in parallel, utilizing a special power-management interface module. The system provides complete power redundancy with *hot-swap* capability.

- **Way More Power.** With 50 amps of 12-volt power available for start-up, the TP900 easily runs up to 13 power-hungry drives. Perfect for the next generation of super network servers.
- **No Downtime.** In the unlikely event that one of its Turbo-Cool 450s should fail, an alarm sounds, and the server is sustained by the TwinPower's other TC450, while the user simply swaps in a new unit.



The TwinPower 900 comes in a monster case that holds two TC450 power supplies, the interface module, 6 fans, an 8-slot or 12-slot motherboard, and up to 13 drives. So, not only do you get the ultimate in power and reliability, you also get the ultimate in system expandability!

TWIN-POWER 900 W/CASE $1695

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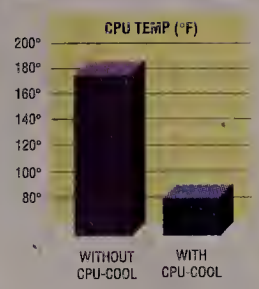

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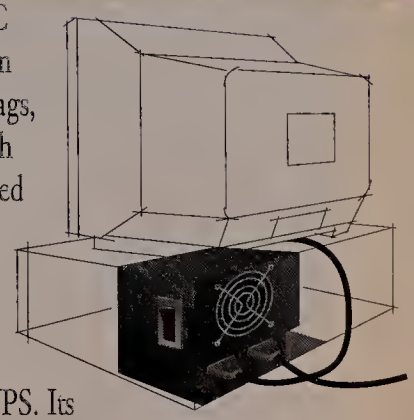

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Circle 195 on reader service card

ers. Xante claims that boosting memory from the standard 8MB to 12MB allows dual-page processing for improved speed (*PC World* did not test this claim).

One feature we particularly liked was ½MB of flash ROM (expandable to 1MB) that can be used for permanent, quickly accessed font storage. Called Virtual Disk Technology, it allows a user to permanently install up to 15 standard typefaces in the printer. If you need space for even more fonts, the Accel-a-Writer 8000 offers a SCSI port for an external hard drive.

Though we were pleased with the Xante Accel-a-Writer 8000's output quality, the combination of slow performance and high cost mitigates our recommendation.

600 DPI—Can You See the Difference?

The table below reports the results of our output quality and printer speed tests. When you look at printer output in a typical office, you don't get out a magnifying glass and scrutinize every character and line to check if you can make out jaggies. Instead, you glance at the printout and simply say, "Looks good," or "This needs work," as the case may be. We decided to test output the same way. A panel of ten judges, mostly ordinary office computer users, with a few graphics professionals thrown in, rated three very different output samples. The result given below is the combined score for each printer.

Surprisingly, given personal preferences, the judges voted virtually unanimously. On the whole, the 600-dpi printers clearly produce better output. The NewGen is a notable exception because of its extremely dark output. The Lexmark is also an unexpected exception. It does not include resolution enhancement in 600-dpi mode, which may explain why it did badly. Compaq's 800-by-400-dpi printer made a strong showing. It would seem from these results that it's better to increase resolution both vertically and horizontally than in only one direction, as the Kyocera and Okidata printers do.

Our testers scored all the printers close together on text-based output and noticed much more marked differences on graphical output, confirming that it's in graphics that higher-resolution printers really shine.

> On the whole, the 600-dpi resolution printers clearly produce better output.

Performance tests were each done twice, once by firing up the printer from power-off and printing each set of test pages fresh. This tests the basic rendering speed and printer engine speed. We then retested after printing the first set, using the same documents. This allowed the printers to get any benefit they could from techniques like font caching—holding fonts in printer memory in case they get reused. Only the Kyocera gained any noticeable benefit from this.

The Compaq Pagemarq 20 was clearly the speed king, finishing first on every test. The NewGen also did well, particularly on the graphics pages from *Excel* and *PageMaker*. The Lexmark fared poorly, finishing last or near last in every test.

High-Resolution Printers: Speed and Print Quality Come Together

	OUTPUT QUALITY (1 to 100 scale)	PERFORMANCE (in seconds) Excel 4.0	WordPerfect 5.1	PageMaker 4.0	Overall
Hewlett-Packard LaserJet 4*	72	32	42.5	36	[illegible]
Xante Accel-a-Writer 8000	71	29	60.5	38.5	[illegible]
Compaq Pagemarq 20*	67	25.5	25.5	27	[illegible]
Kyocera Ecosys a-SI	61	30	35	49	[illegible]
IBM LP 10P/Lexmark	55	42	61.5	50	[illegible]
Okidata OL810	50	29.5	41	52	[illegible]
NewGen TurboPS/660	37	27.5	46.5	30.5	[illegible]

*Best Buy

Printers are listed in order of output quality, from best to worst. Performance ratings are in seconds.

Methodology
All printers are configured as standard for performance tests and with the minimum RAM necessary to achieve maximum resolution for output tests.

Output
We test printer output using three samples printed from each machine at its highest resolution. The samples test gray-scale output, graphics output, text output, black levels, and halftoning. The score given is a composite rating from our ten testers, who score each printer's output on a scale of 1 to 10 without knowing which printer produced it.

Performance
Each test for each printer is run twice. The first test is run right after turning the printer on, before anything else is printed. The same test is then repeated to allow any benefits from font caching to come into play.

Excel 4.0 We print a simple one-page spreadsheet file.

WordPerfect 5.1 We print a three-page text document. The score given is a total for all three pages, with the first page taking most of the time and subsequent pages printing rapidly.

PageMaker 4.0 We print a landscape text page with straightforward formatting, a strong ruler bar, and an embedded halftone image.

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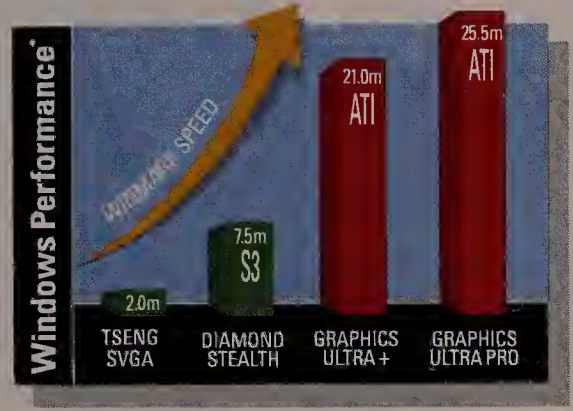

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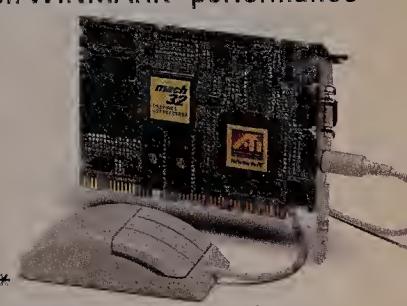

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FEATURES COMPARISON

Enhanced-Resolution Printers

● Yes
○ No
n/a = not available

	Compaq Pagemarq 15	Compaq Pagemarq 20 (BEST BUY)	Hewlett-Packard LaserJet 4 (BEST BUY)	Hewlett-Packard LaserJet 4M	IBM LaserPrinter 10P/ Lexmark	Kyocera Ecosys a-Si	NewGen Systems TurboPS/660	Okidata OL810	Xante Accel-a-Writer 8000
Standard features									
List price	$3999	$5499	$2199	$2999	$3795	$2395	$3495	$1699	$3295
Engine	Fuji Xerox	Fuji Xerox	Canon P-270	Canon P-270	Lexmark US	Kyocera	Canon LBP-SX	Oki Electric	Canon LBP-SX
Rated engine speed (ppm)	15	20	8	8	10	10	8	8	8
Footprint (square inches)	349	349	257	257	293	187.7	506	306	576
Duty cycle (K pages)	50	50	20	20	20	30	5	16	10
Integrated toner-drum cartridge	●	●	●	●	●	○	●	○	●
Toner cartridge life (K pages)	12	12	6	6	15	5	4	2.5	4
Maximum resolution (dpi)	800 x 400	800 x 400	600 x 600	600 x 600	600 x 600	300 x 1200[1]	600 x 600	300 x 1200[1]	600 x 600
Standard memory (MB)	4	4	2	6	5	1	6	1	8
Maximum memory (MB)	18	20	34	26	9	5	32	5	16
Memory add-ons	standard SIMM	standard SIMM	standard SIMM	standard SIMM	proprietary card	proprietary card	proprietary card	proprietary card	standard DRAM
Fonts and emulations									
PCL 4/5	5	5	5[2]	5[2]	4[3]	5	4	5	4
PostScript	Level 2	Level 2	Level 2 option	Level 2	Level 1	Level 1 option	Level 1	Level 1 option	Level 1
Other	●	○	IBM Proprinter Epson option	IBM Proprinter Epson option	PPDS	Diablo 630 IBM Proprinter Epson	Epson option	IBM Proprinter	●
Emulation sensing	●	●	○[4]	○[4]	○[4]	○[4]	○[4]	○[4]	○[4]
Fixed	7	7	1	1	10	79	1	42	12
PostScript	35	35	0	35	35	0	35	0	0
PCL	8	8	45	45	35	13	35	13	35
Design and construction									
Serial	1	1	1	1	1	1	1	0[5]	1
Parallel	1	1	1	1	1	1	1	1	1
AppleTalk option	●	●	●	●[6]	●	●	●[6]	●	●[6]
Ethernet option	●	●	●	●	●	●	●	○	○
Token ring option	●	●	●	●	●	●	○	○	○
Paper handling									
Standard input capacity (sheets)	750	1500	350	350	200	250	200	200	200
Maximum input capacity (sheets)	1000	1500	850	850	700	1250	200	400	200
Maximum output capacity (sheets)	500	500	250	250	250	750	200	200	100
Maximum paper size (inches)	11 x 17	11 x 17	8.5 x 14	8.5 x 14	11 x 14	8.5 x 14	8.5 x 14	8.5 x 14	8.5 x 14
Envelopes	●	●	●	●	●	●	●	●	○[7]
Envelope feeder	○[7]	○[7]	○[7]	○[7]	○[7]	○[7]	○[7]	○	○[7]
Duplex	○	○	○	○	○	○[7]	○	○	○
Service and support									
Warranty (years)	1	1	1	1	1	1	1	1	1
Toll-free tech support	●	●	○	○	○	●	●	●	●
Daily support hours	12	12	11	11	10	10	11	10	12
On-site service	●[8]	●[8]	●[9]	●[9]	●[10]	n/a	●[11]	●[12]	○

[1] Via advanced resolution enhancement.
[2] Enhanced PCL 5.
[3] PCL 5 option.
[4] Failed test.
[5] Serial port option.
[6] Included.
[7] Available as an option.
[8] Free.
[9] For $276.
[10] Available via dealer.
[11] For $499.
[12] Available via third party.

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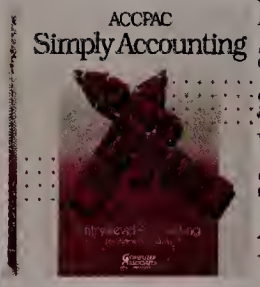

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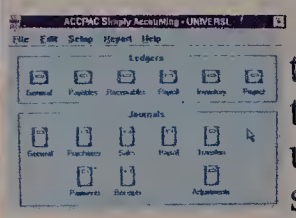

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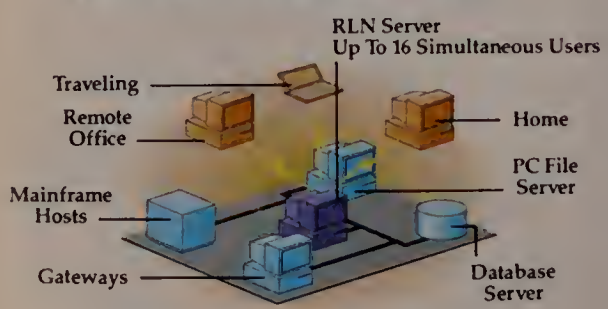

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NYSE Reported Profit Taking Activities
MultiSync 4FG

as carpal tunnel syndrome. Of course, moving to high resolution is pointless if the screen characters at that resolution are so small, or so blurred, that they cause eyestrain. The solution is simple: Buy a big-screen monitor with a good, sharp, steady image. The trick is finding one that's affordable.

For your viewing pleasure, the PC World Test Center sorted through the latest crop of large-screen monitors and found 17 that are worth a serious look. Our selection criteria were a flat screen of 15 inches or more diagonally; 1024 by 768 resolution; flicker-free image at 1024 by 768; and a dot or stripe pitch of .28mm or better. (The image on most screens is made up of tiny red, green, and blue phosphor dots. The screens of Trinitron monitors use vertical phosphor stripes. Dot or stripe pitch is the distance from one dot or stripe to its nearest neighbor of the same color. Generally, the smaller the dot pitch, the sharper the image.) We also demanded a street price within shouting distance of $1000. (All prices listed here are street prices, which we got by calling several retailers nationwide and averaging the results.)

Here's what we found: More big-screen monitors are available this year than last, giving you a greater selection. There are a lot more flat screens, prices are slightly lower, images are prettier, and two monitors (Compaq's QVision 150 and Sony's CPD-1604S) boast .25mm dot/stripe pitch—a welcome innovation for large-screen units. Unlike last year, every image is evenly focused across the face of the screen, even in the "problem" areas at the top and sides. And we discovered that the best image in the roundup is on a 17-inch monitor: the Best Buy TVM MediaScan 6A.

Best Buy

As always, *PC World*'s Best Buy rating is calculated by ranking an overall combination of price and performance. For these large-screen monitors we factored in price, image quality, size, weight, viewing area, and service and support, along with ergonomic factors such as easy-to-use controls and compliance with SWEDAC emission standards. Although the Best Buy 17-inch TVM MediaScan 6A Digital is prettier than the Best Buy 15's, the lower prices for the smaller units give them an extra boost, and their smaller size makes them easier to stuff into cramped quarters.

1. **Mag MX15F**
2. **NEC MultiSync 4FG**
3. **TVM MediaScan 5A+ LR**
4. **TVM MediaScan 6A Digital**

Doctor, My Eyes...

We are also pleased to report there is less flicker, thanks to faster refresh rates. A faster refresh rate (the number of times per second that the monitor's electron gun repaints the image) means a steadier image—and less eye fatigue. Until a couple years ago, 60 Hz was considered acceptable—but while a 60-Hz flicker is *almost* imperceptible, after long hours staring at a monitor your eyes can feel it. Studies have shown that 70 Hz is a lot easier to take. Our tests confirm that every monitor here meets or beats that standard—all the way up to 1024 by 768.

And while no one has yet proven that a monitor's electromagnetic fields constitute a health hazard, radiation is radiation—and many users are concerned about possible health risks from large-screen units. Fortunately, nine of the monitors reviewed in this article meet or exceed the SWEDAC international low-emission guidelines.

Screen Size Isn't Everything

As you increase the resolution of a CRT screen, you see more of your spreadsheet or presentation—but there's a nasty tradeoff: Numbers and letters get smaller. That's because screen characters are composed of a fixed number of dots. Take a capital "I," for instance; it's 10 dots tall—and measures ¼ inch on a standard 640 by 480 VGA screen. If you double the resolution without changing the screen size, the dots end up twice as close together—and a 10-dot *I* will shrink to 1/8 inch. If you spend all day in front of your CRT, those tiny fonts can expand into a huge headache.

However, if you paint that same *I* on a bigger screen, it grows proportionally larger—the way letters on a balloon expand as you blow in air. *Windows* screen fonts that are a mere ⅛-inch tall (.125 inches) on a 12-inch monitor grow to 5/32 (.156) inch on a 15-inch screen, and become almost 3/16 (.187) inch on a 17-inch monitor.

"Official" screen size is the diagonal measure of the picture tube before it's mounted in the cabinet. Subtract for the plastic bezel, and you end up with a screen that's always smaller than advertised. Typically, a "15-inch screen" is actually 13½ inches. The total viewable image area in square inches is a better way to compare screen sizes (you'll find this number in the Features Comparison). On average, 17-inch monitors provide 33 percent more viewing area than 15-inch monitors.

Image Ergonomics

As screen resolution increases, more demands are placed on a monitor's electronics, which may cause the image to grow fuzzy or harsh. While only a few users employ 1024 by 768 resolution very often—mainly desktop publishers who want to look at a two-page layout, or managers who need to get all of a complicated spreadsheet on screen—it's still the most demanding test of a monitor's sharpness. That's why we've paid a lot of attention to how these monitors look at the higher resolutions. If the screen is crisp at 1024 by 768, you can be sure it will be fabulous at 800 by 600. A limited range of hues can give images a harsh, cold appearance. Most of the monitors in this roundup display excellent sharpness

Only desktop publishers who want to look at a two-page layout, and managers who need to get all of a complicated spreadsheet on screen, will use 1024 by 768 very often. But it's still the most demanding test of a monitor.

and good color range at the highest resolutions, but a few fuzz out as they approach 1024 by 768.

Size Up or Ship Out

Multiscan monitors are designed to support more than one screen resolution, but *Windows*, which permits you to switch rapidly between applications that may use wildly different resolutions, can throw these units for a loop. When you switch video modes, a change in image size (or a loss of image) is all too common.

Fortunately, ten of the monitors we tested have a microprocessor controller that senses the video mode and adjusts the image according to factory—or user—preset values, maintaining a constant image size. And with the exception of the Amdek AM/815, all the manually controlled monitors we looked at are so finely tuned that they need little or no user adjustment.

If you do need to make adjustments, the screen controls for these monitors are uncommonly versatile. Just make sure the controls and power switch are accessible from the front of the monitor—or plan on growing gorilla-length arms. Eight monitors have a recall button to bring the screen back to factory specs should you find that your screen adjustments have landed you in the twilight zone.

Service and Support

Because these monitors are more complex than standard VGA monitors, more things can go wrong. Any day when you turn on your system, and the monitor makes a snapping sound—followed by a small, bright dot in the middle of the screen instead of your *Windows* desktop—is a very bad day. A two-year warranty, which four of these monitors provide, is obviously better than the standard one-year warranty.

A central support number with long hours can help you fix minor monitor problems, especially those due to user maladjustments—but most breakdowns require a qualified repair technician. You can take the defective unit to a repair depot, but most companies prefer that you send it back for repair or replacement. Four companies offer overnight express replacement, and two vendors, Compaq and HP, have free on-site 48-hour service.

Crystal-Clear Choices

Of course, better electronics cost more—which is why these monitors are pricey. The 17-inchers cost more than the 15's, because the CRTs are more expensive—and the best of the 17's have better electronics than the best of the 15's. Still, you can pick up one of our 15-inch Best Buys (the TVM) for $592, or go all the way to 17 inches with IOcomm's impressive ThinkSync 7A for only $876.

We found four Best Buys—three 15-inch monitors and one 17 incher. In the smaller form factor, Mag's MX15F and NEC's 4FG stand head and shoulders above the rest because of their outstanding screen sharpness. We also found an exceptional value in TVM's MediaScan 5A+LR, which delivers a fine, crisp image. Choosing a 17-inch winner was even more difficult, because the 17's are more closely matched in price and performance. TVM's MediaScan 6A Digital is our Best Buy due to its exceptionally sharp, saturated image, with Mag's MX17F and the ViewSonic 7 close behind.

For more information about all products in this article, circle reader service number 902.

Best Price

When you buy a large-screen monitor, you're paying for a huge CRT tube as well as advanced electronics—so it shouldn't come as a surprise that 17-inch units usually cost a lot more than 15's. Nonetheless, there's a range of prices at both form factors. You can pay as much as $875 for a 15-inch unit, which makes these under-$600 units impressive bargains. But the real steal of the roundup is IOcomm's 17-inch ThinkSync 7A, which costs only $876—hundreds less than comparable units. But the old adage "it's hard to beat the master" still applies–so NEC's $1350 5FG is not to be ignored.

15-inch

Amdek AM/815 $580

Relisys RE1558 $590

TVM MediaScan 5A+LR $592

17-inch

IOcomm ThinkSync 7A $876

Amdek AM/817 $1041

Best Image

Image quality is a complex combination of factors that encompasses large viewing area, small dot/stripe pitch, good design, reliable quality control during manufacture, sophisticated electronics, range and gradation of color and hue, and brightness and contrast controls that let you adjust the unit for optimal sharpness. Of course, everyone's "eye" is different, and one person's favorite monitor may not meet the needs of another user. Still, while every monitor in this roundup looks great next to a run-of-the-mill 12-inch VGA, we consider these four monitors the best of the best.

15-inch

TVM MediaScan 5A+LR

Mag MX15F

17-inch

TVM MediaScan 6A Digital

ViewSonic 7

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Trade-in Program	No	No	Yes
Licensed Education Centers	No	No	Yes
30-Day Money-Back Guarantee	Yes	No	Yes

Source: Dataquest Ledgeway, 7/92.

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15-INCH MONITORS

Amdek AM/815

PROS: Inexpensive, small size **CONS:** Fuzzy, no automatic image sizing
Contact: 800/722-6335, 800/742-6335 (fax) **Reader service no. 660**

At an estimated $580 on the street, the 15-inch Amdek AM/815 is the cheapest monitor in this roundup. Unfortunately, at 1024 by 768, *Windows'* fonts lose their sharpness. Also, because the AM/815 lacks a microprocessor, you'll have to reach for the size and position controls whenever you change video modes. Thankfully, the thumb-wheel controls are easy to access and adjust. While the AM/815 is acceptable for 800 by 600 use, it's outclassed at higher resolutions. And it has one of the smaller screens in its class. Still, a monitor that makes this cut and sells for under $600 is a win-win deal.

Compaq QVision 150

PROS: Flat screen, vibrant colors, free on-site service **CONS:** Big, heavy, expensive
Contact: 800/345-1518, 713/378-8820 **Reader service no. 661**

Although many vendors advertise "flat" monitors, every screen we tested has a slight curvature—except for this one. Compaq's 15-inch QVision 150 screen, which is so flat it looks concave, uses the flat-tension mask (FTM) technology first seen in Zenith's renowned ZCM monitors. This CRT has razor-sharp .25mm dot pitch and an excellent 100 to 1 contrast ratio, resulting in the most vibrant colors you've ever seen on a monitor screen—and focus is good even at 1024 by 768. The drawbacks are a box big enough to house a standard 17-inch monitor, a near 50-pound heft that will put a dent in even the strongest case, and the highest street price for any 15-incher here: $875. This is an excellent monitor, but buy it only if your pocketbook and back can take the strain.

Dell 15LR

PROS: Low price **CONS:** Blurry at 1024 by 768, large
Contact: 800/289-3355 **Reader service no. 662**

Dell's 15LR 15-inch monitor (actually built by NEC) is crisp at 800 by 600 but not sharp enough for extended use at 1024 by 768. Image sizing is steady when you change modes, despite the lack of a microprocessor, and the side-mounted controls are easily accessible. At $699, the midpriced 15LR is a solid monitor—as long as you don't need high-resolution performance. When packaged with a Dell PC, it makes the perfect video companion.

IOcomm ThinkSync 5

PROS: Small, lightweight **CONS:** No automatic image sizing
Contact: 800/998-8919, 310/644-6100 **Reader service no. 663**

With a midrange price tag of $700, IOcomm's 15-inch ThinkSync 5 won't break your piggy bank. Or your back: This monitor weighs only 31.5 pounds. Despite its slim 14-by-15.8-inch profile, the 91-square-inch screen is one of the biggest of the 15's. And its image is good and crisp—at least at low resolutions: At 600 by 800, text looks fine, but at 1024 by 768, it loses crispness. And plan on doing some knob twisting, because there's no microprocessor, so the image size will need tweaking when you switch resolution or graphics modes. Happily, the adjustments are minimal, and you probably won't use them unless the new screen proportions are unbearable. The ThinkSync is a very good buy, and one you'll be happy with. But for just $176 more, you can buy IOcomm's equally enjoyable 17-inch CM7128A.

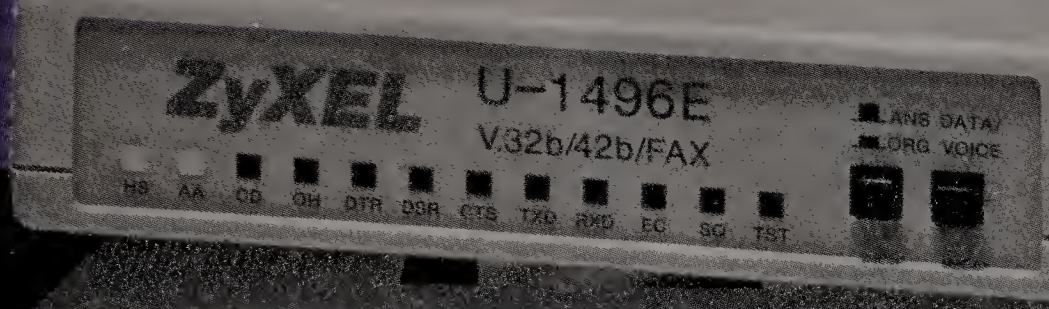
In addition to sporting a Best Buy award, the Mag MX15F is the only 15-inch monitor to display the current video mode.

Mag MX15F

PROS: Outstanding image quality, biggest 15-inch screen reviewed, small chassis
CONS: None **Contact:** 714/827-3998 **Reader service no. 664**

The Mag MX15F's 92 square inches make it the biggest 15-inch screen we've seen. Its image is one of the best too: sharp enough to display 1024 by 768 images you can work with all day long—in a space where no 17-inch monitor could fit. True, at highest resolutions the text is small, but it's admirably crisp and clear. The color range is exceptional too, and the microprocessor does an excellent job of properly sizing and positioning up to 26 different factory- and user-present (13 each) video screens. And there's a nifty LED indicator that displays your PC's current video mode, which is handy when you need to switch between *Windows* and DOS applications. Better yet, the Mag MX15F is affordable at $691. No wonder it walks away with a Best Buy—for the second year in a row.

WEIGH THE OPTIONS



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Hayes Ultra 14.4	$999	YES	NO	NO	NO	NO	NO
U.S. Robotics Courier V.32bis	$995	YES	YES	NO	NO	NO	NO
Telebit T3000	$949	YES	YES	YES	NO	NO	NO
Multimodem MT1432BA	$899	YES	YES	YES	NO	NO	NO
ZyXEL U-1496E	$469	YES	YES	YES	YES	YES	YES

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Comparison chart was completed in May, 1992.

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Visit us at COMDEX Fall '92, North Hall 4644

For most people, NEC's MultiSync 4FG is all the monitor they'll ever need. Its sharp, clear, saturated image is absolutely impeccable.

NEC MultiSync 4FG

PROS: Excellent image quality **CONS:** Pricey
Contact: 800/388-8888, 800/366-0476 (fax) **Reader service no. 665**

Once again, NEC's 15-inch 4FG takes home a Best Buy award. It puts such a sharp, clear image on the screen, even at 1024 by 768, that we found it less tiring to work with at high resolutions than several 17-inch monitors. Of course, the screen fonts aren't as big as on a larger monitor, but tonal range is excellent, and the image is always perfectly sized in all video modes. You'll also be happy to hear that the 4FG has the same color temperature features as the 5FG (see the sidebar "Is Your Monitor Color-Blind?"). For clarity's sake, NEC doesn't use an antiglare coating, so if glare is a problem, buy the optional glare filter ($79). At $778, it's expensive for a 15-incher, but, as the old saying goes, good things don't come cheap. If you find the 4FG too pricey, you may want to consider NEC's 3FGX, which sells for "only $665." It doesn't support all the 4FG's video modes (or color-matching feature), but the few that are lacking (notably 70-Hz refresh at 1024 by 768) are troubling only to demanding high-end users.

Relisys RE1558

PROS: Low price, two-year warranty **CONS:** Lacks sharpness
Contact: 408/945-9000 **Reader service no. 666**

When a company like Relisys puts a 15-inch monitor such as the RE1558 on sale for a lowball street price of only $590, it's guaranteed to get our attention. What we see is a well-designed 91-square-inch display with good image sizing (despite the lack of a microprocessor) and a generous two-year warranty. Unfortunately, what we *don't* see is an image that's sharp enough to use beyond 800 by 600 without eyestrain.

Taxan MultiVision 550

PROS: Exceptional image quality, small chassis, lightweight **CONS:** Pricey
Contact: 800/648-2926 **Reader service no. 667**

For sheer gorgeousity, Taxan's 15-inch MultiVision 550 has no equal. Its range of hues is excellent, and its image sharpness is the best of the 15's—it can be used comfortably at 1024 by 768. Moreover, although it lacks microprocessor control, it needs almost no image-sizing adjustment between video modes. The warranty is a long two years, and you can buy an insurance policy that guarantees overnight replacement should your monitor fail during the warranty period. However, $725 is not cheap—and for $133 less you can buy TVM's Best Buy MediaScan 5A+LR: a microprocessor-controlled monitor that puts out an image that's almost as great.

TVM MediaScan 5A+LR

PROS: Low price, good image quality **CONS:** Small screen
Contact: 714/988-3368 **Reader service no. 668**

Occasionally, we run across a bargain that seems too good to be true. TVM's 15-inch monitor falls into that category. Its $592 street price is just $12 above the lowest here, yet it offers features and benefits you won't find in monitors costing twice as much. Its screen image is impeccably sharp and detailed. It boasts an excellent range of color hues and shades. And no matter how quickly we switched video modes, or how different they were, the 5A+'s microprocessor shifted through the video-mode gears with matchless perfection.

Our only complaint is that its 87-square-inch screen is tied for the smallest in the 15-inch group. Nonetheless, if you're looking for the biggest bang for your buck, this is a big bang. We don't hesitate recommending this monitor to even the most discerning user.

At only $592 on the street, TVM's 15-inch MediaScan 5A+LR is a genuine bargain. Its microprocessor holds images steady.

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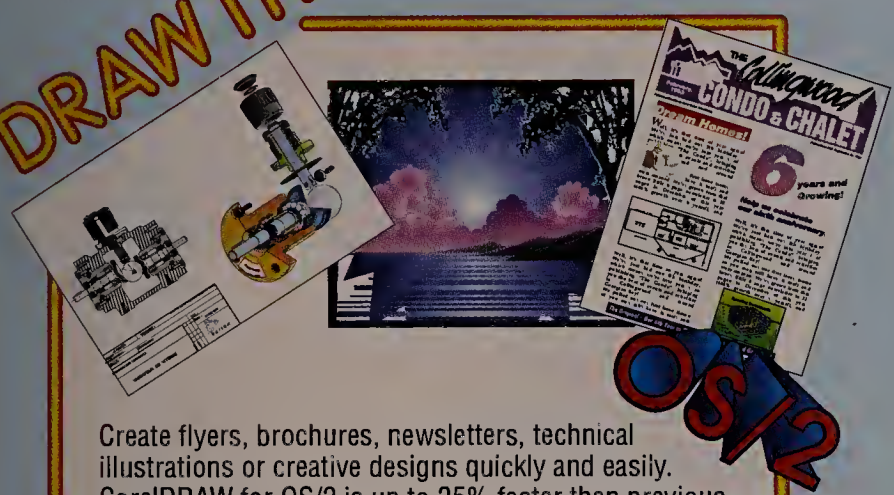

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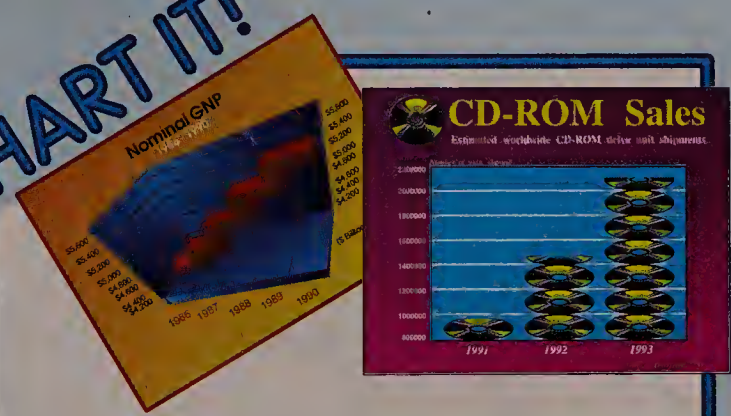

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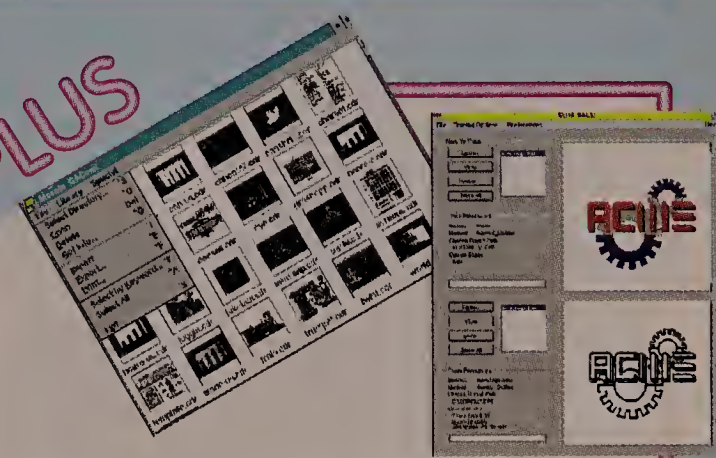

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17-INCH MONITORS

Amdek AM/817

PROS: Reasonably priced **CONS:** Fuzzy at higher resolutions
Contact: 800/722-6335, 800/742-6335 (fax) **Reader service no. 669**

If you stay in shallow water—800 by 600 resolution—the 17-inch Amdek AM/817 looks great. But when you swim out to 1024 by 768, text isn't as sharp as the other 17-inch monitors here. Fortunately, its big screen paints the letters and numbers large enough that you may not notice the blurry edges of the characters. We also like its $1041 street price—relatively modest for a 17-inch unit. Although it's not one of our picks, it survived the rigorous PC World Test Center gauntlet.

HP Ultra VGA 17-inch Display

PROS: Good color range, free on-site service **CONS:** Expensive
Contact: 800/752-0900 **Reader service no. 670**

HP's new Ultra VGA 17-inch Display is a high-quality monitor that has more than a few good things going for it—not the least of which is free on-site service. The screen is rock steady in all video modes, and its range of hues is better than average, but not as good as the best. Overall image sharpness is fairly crisp—all the way to its easy-to-read 1024 by 768. However, the Ultra VGA's $1150 price tag is only nine bucks shy of the highest here. This is an impressive machine, but you'll do better with one of our Best Buys.

IOcomm ThinkSync 7A

PROS: Low price, excellent color range **CONS:** Lacks definition at 1024 by 768
Contact: 800/998-8919, 310/644-6100 **Reader service no. 671**

If your eyesight demands a 17-inch screen, but your pocketbook says no, IOcomm's ThinkSync 7A may be the answer. With an astounding street price of only $876, it's far and away the cheapest 17-inch monitor here. In fact, it's a lot closer in cost to many 15 inchers. While its 118-square-inch screen is one of the smaller 17's, its fine gradation between color shades effects a smooth blend of hues that surpasses monitors costing hundreds more. Despite its lack of microprocessor control, image sizing is reasonably well behaved, with the merest twist needed now and then. Another problem: Its focus at 1024 by 768 is just average. Nonetheless, its low price and good-looking image make it an excellent choice for budget-minded users with eyes for size.

Mag MX17F

PROS: Excellent clarity **CONS:** Relatively small screen, big chassis, heavy
Contact: 714/827-3998 **Reader service no. 672**

While 116 square inches is the smallest screen in the 17-inch group, it's still huge compared to the monitors we're used to. Moreover, the sharpness of the $1090 MX17F's image highlights the excellent clarity that can be achieved when you marry small .26mm dot

Is Your Monitor Color-Blind?

One of the most important jobs you'll want your big-screen monitor to perform is to help you prepare good-looking business presentations. That's why we've paid such close attention to these monitors' range of color shades—whether their transition from pure red to pure blue, say, is harsh or gradual. Happily, most of the displays come through with flying colors.

But what you see on screen is not necessarily what you get on the printed page or overhead slide—even if you use an expensive, top-of-the-line color printer or a professional printing company. Shining gold can transmute into straw-colored tan, vibrating red may turn to mud—and your crucial business presentation or sales demo could look tacky as a result. The fault is not in the monitor, the color printer, or your printing house: The fault—if you can call it that—is in the way the eye perceives colors.

Video monitors use the additive color method: Three light sources in the primary colors of red, green, and blue are blended together to create white. If the intensity of any of the three colors changes, a hue is generated—pink or purple, for example. Color printers, on the other hand, use the subtractive color method: Dyes or pigments are used to absorb certain colors and reflect others, giving the paint or ink its characteristic tint. The problem is, the two methods don't always match perfectly—especially when it comes to producing subtle shades and hues.

Fortunately, a few monitors can help alleviate this problem by letting you adjust the screen colors to match those of your printer. They give you individual control over the intensity of the red, green, and blue electron guns—an adjustment often referred to as "color temperature."

For example, if the headline text in your overhead slide has shifted to olive drab from the shamrock shade that looked so compelling on your screen, all you have to do is adjust the intensity of the green gun so the screen green looks olive too. Now that you've synced the monitor and the printer, use your on-screen presentation package to reset the headline to shamrock—and that's what you'll get in print too.

The only downside is cost. Circuitry to adjust color temperature definitely raises the price. NEC's 15-inch 4FG is the only monitor in the roundup that lets you adjust color temperature, and it's one of the pricier 15's. Two 17-inch monitors, Mitsubishi's Diamond Pro 17 and NEC's MultiSync 5FG, boast the same feature, plus images that are as good or better than the best monitors in this review. But the Diamond Pro 17 costs $1306 on the street, and the 5FG will run you $1350—which is why these two outstanding units are in a sidebar to our review, not the main text. ***—TJB***

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pitch with a 17-inch screen. Even at the highest resolutions, text is so large and clear that most users won't believe their eyes. Automatic image sizing is good, too, and there's a cute LED indicator (just like the one on the MX17F's 15-inch counterpart) that displays the current video mode. The bad news: The unit's bigger and heavier than many tabletop TVs. However, unless your desktop is really cramped, that's not enough reason to reject this beauty.

Samsung SyncMaster 5c

PROS: Large screen **CONS:** Big, could be sharper
Contact: 800/446-0262 **Reader service no. 673**

At $1073, the 17-inch Samsung SyncMaster 5c isn't cheap. But this unit packs a generous 123-square-inch screen (the second biggest in the roundup) on which even 6-point fonts come up so large that squinting is seldom required. Plus the microprocessor does an excellent job of maintaining image size and position no matter how many resolutions you cycle through—if you don't mind a 5-second wait for the new video mode to settle in. However, focus at 1024 by 768 is only average (despite a fine 0.26-mm dot pitch), the cabinet dimensions are next to the largest, and a limited range of hues can make some images look harsh. With so many better 17-inch choices, this is not your best pick.

Sony CPD-1604S

PROS: Excellent sharpness **CONS:** Expensive, adjustments hard to reach
Contact: 800/352-7669 **Reader service no. 674**

Sony's 17-inch CPD-1604S proves once again that it's hard to beat a Trinitron CRT for bright colors and exquisite sharpness at 1024 by 768. Unlike the other CRTs in this review, the Trinitron uses color stripes instead of color dots to create its screen images. The result is square, rather than round, pixels, with no "dead" space between them—making images brighter and better defined. Its 124-square-inch screen is the biggest in the roundup, yet the unit is lightweight for a 17-inch monitor. And despite the lack of a microprocessor, image size stays steady enough that you won't need the controls very often. But there the good news ends. Still annoying is the "draw-string" line (a tension wire used inside the CRT) which casts a shadow on the screen. The line is most noticeable on a *Windows* white screen. The limited color range produces the coldest-looking screen we've ever seen. The side-mounted twist-knob screen controls are hard to reach and harder to adjust. And get plenty of money ready—because at $1159 this is the most expensive monitor in this roundup. Unless you insist on a Trinitron screen, look elsewhere.

TVM MediaScan 6A Digital

PROS: Stupendous image quality, two-year warranty **CONS:** Big, heavy
Contact: 714/988-3368 **Reader service no. 675**

If you have $1108 that's burning a hole in your pocket, you could do a lot worse than spend it on TVM's 17-inch MediaScan 6A Digital. The range and gradation of color shades are the finest we've seen, and image sharpness at 1024 by 768 is second to none—despite a relatively coarse 0.28-mm dot pitch. A lot of the screen's definition is a direct result of its large 122 inches of viewing area. That renders *Windows* fonts so large that even at the highest resolutions you won't need your reading glasses. The warranty is a long two years, and repairs take only two days. The only downsides are that the screen breaks up momentarily while the microprocessor shifts video modes (annoying, but not life threatening)—and that this unit occupies the most space of any monitor here. And weighing in at 51 pounds puts it just one and a half pounds short of qualifying as the heaviest monitor in the roundup. But don't worry, be happy: If you think the upsides balance the downs to add up to a Best Buy, you're right.

TVM's 17-inch MediaScan 6A is a Best Buy, despite its considerable size and weight. It delivers outstanding sharpness and color range.

ViewSonic 7

PROS: Small, light, good image quality **CONS:** Pricey
Contact: 800/888-8583, 909/869-7976 **Reader service no. 676**

At just under 44 pounds, the 17-inch ViewSonic 7 is relatively lightweight. Its range of hues is excellent, you get a roomy 121 square inches of viewing area, and its microprocessor remembers and displays up to 26 different video modes flawlessly. Moreover, ViewSonic provides technical support 10 hours a day, including weekends. And if your ViewSonic monitor ever needs to be repaired, the company promises you'll never go longer than 24 hours without a replacement. So what's the catch? While its image sharpness at 1024 by 768 is fine, many other 17-inch monitors are better—and the ViewSonic sells for a pricey $1140. In a speedy pack like the machines in this review, it doesn't take much to slip out of the winner's circle—but make no mistake, the ViewSonic 7 is a great buy.

TJ Byers is a contributing editor for PC World. *He can be reached on PC World Online (see page 8 for more information).*

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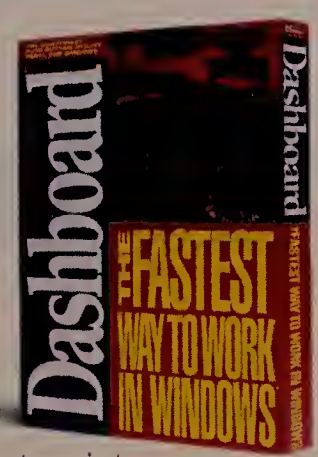

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FEATURES COMPARISON

Big-Screen Monitors: When the Quality Is as High as the Resolution

● Yes
○ No
n/a = not applicable

	Amdek AM/815	Amdek AM/817	Compaq QVision 150	Dell 15LR	HP Ultra VGA 17-Inch Display	IOcomm ThinkSync 5	IOcomm ThinkSync 7A
Standard features							
List price	$699	$1299	$899	$699	$1449	$795	$995
Street price	$580[1]	$1041	$875[1]	$699	$1150	$700	$876
Video mode indicator	○	○	○	○	○	○	○
Screen							
CRT size (diagonal inches)	15	17	15	15	17	15	17
Viewable area (square inches)	89	118	87	91	119	91	118
Dot/stripe pitch (mm)	0.28	0.26	0.25	0.28	0.28	0.28	0.26
Dimensions and weight							
Height (inches)	14.5	17	15.9	15.5	16.8	14	16.1
Depth (inches)	15.2	16.5	16.7	17.4	17.1	15.8	18
Volume (cubic inches)	220.4	280.5	265.53	269.7	287.28	221.2	289.8
Weight (pounds)	36	47.375	49.375	41.875	44.75	31.5	50.75
Controls							
Microprocessor controlled	○	●	●	○	●	○	○
Power switch, brightness, contrast all on front panel	●	●	●	●	●	●	●
Reset/recall	○	●	●	○	○	○	○
Pincushion/barrel convergence	●	○	○	●	○	●	○
Manual degauss	●	●	●	●	○	○	●
SWEDAC emission compliance	●	○	●	●	●	○	○
Service and support							
Warranty (months)	12	12	12	12	12	12	12
On-site service less than $100	○	○	●	○	●	○	○
Toll-free support	●	●	●	●	●	○	○
Daily support (hours)	8	8	12	15	9	9	9
Weekend support	○	○	○	●	○	○	○
Electronic BBS support	●	●	●	●	○	○	○
Fax support	●	●	●	●	○	●	●
Turnaround policy	3 days	3 days	48 hours	24 hours	48 hours	3 days	3 days

[1] Estimated street price. [2] 24 months on CRT. [3] 24-hour answering service. [4] Next-day replacement via Federal Express at extra cost.

Passing the DisplayMate Test

Testing a high-resolution, big-screen monitor is not easy. For our primary testing tool, the PC World Test Center chose *DisplayMate*, a video evaluation program from Sonera Technologies (800/932-6323, 908/747-6886). *DisplayMate*, which costs $149, is a software package designed for users who want to adjust their monitors for the best possible image. Among its battery of benchmarks are intricate geometric patterns, delicately shaded color bars, and gray scales that let the user tweak the brightness and contrast controls for optimum display.

DisplayMate Professional

For $100 more, Sonera Technologies sells an upscale version, *DisplayMate Professional*, that's designed to ferret out kinks in video systems at the production and engineering levels. It contains everything *DisplayMate* does, plus the capability to exercise monitors at resolutions up to 1280 by 1024. We used this package to look into the inner video secrets of these big-screen monitors.

We found *DisplayMate* easy to use—and highly revealing. Those cute patterns are actually hard-core benchmarks that push

	BEST BUY Mag MX15F	Mag MX17F	BEST BUY NEC MultiSync 4FG	Relisys RE1558	Samsung SyncMaster 5c	Sony CPD-1604S	Taxan MultiVision 550	BEST BUY TVM MediaScan 5A+LR	BEST BUY TVM MediaScan 6A Digital	ViewSonic 7
	$899	$1549	$949	$699	$1399	$1790	$799	$699	$1299	$1399
	$691	$1090	$778	$590[1]	$1073	$1159	$725	$592	$1108	$1140
	●	●	○	○	○	○	○	○	○	○
	15	17	15	15	17	17	15	15	17	17
	92	116	91	91	123	124	91	87	122	121
	0.28	0.26	0.28	0.28	0.26	0.25	0.28	0.28	0.28	0.28
	13.6	16.9	15.6	15.7	17.5	16.9	15.8	15	17.5	16.7
	17.1	19.4	16.3	16	18	17.5	15.3	16	18.5	16.9
	232.56	327.86	254.28	251.2	315	295.75	241.74	240	323.75	282.23
	30	52.75	38.625	33.625	49.125	45.25	30.75	32.25	50.875	43.75
	●	●	●	○	●	○	○	●	●	●
	●	●	●	●	●	●	●	●	●	●
	●	●	●	○	●	○	○	●	●	○
	○	○	○	○	●	○	○	○	●	○
	○	●	●	○	●	○	○	○	●	○
	○	○	●	○	○	●	○	●	●	●
	24parts/12labor	24parts/12labor	24parts/12labor	24	12	12[2]	24	24	24	12
	○	○	○	○	via dealer	○	○	○	○	○
	●	●	●	●	●	○	●	●	●	●
	9	9	9.5	9	8.5	13	10	9	9	10
	○	○	○	○	○	○	○	○[3]	○[3]	●
	○	○	●	○	●	●	●	○	○	○
	●	●	●	●	●	○	●	●	●	●
	3 days	3 days	24 hours	5 days	5 days	48 hours	3 days[4]	2 days	2 days	24 hours

your monitor *and* your video controller to their limits. But a lot of the most useful information is apparent only after you read the illuminating manual. We recommend that you do so; if nothing else, you'll gain an education in video graphics.

Super-VGA Hardware

Once *DisplayMate Professional* was in place, we needed to pick a video board that would exercise *DisplayMate*'s full capabilities. We chose Orchid's Fahrenheit video card with the HiColor option.

TEAM Systems: The Big Gun

Then we put the monitors to the ultimate trial: We fired up TEAM Systems' (800/338-1981) VG-815 digital video generator. The VG-815 is built to push a monitor to its limits, such as forcing it to perform 60-Hz refresh at 1280 by 1024. While you may never use this resolution, the results were critical in arriving at final ratings. And that means if you pick one of our Best Buys, you'll get a unit that's passed the toughest test we could devise.

—TJB

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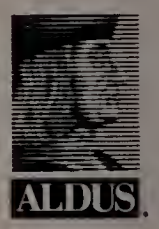

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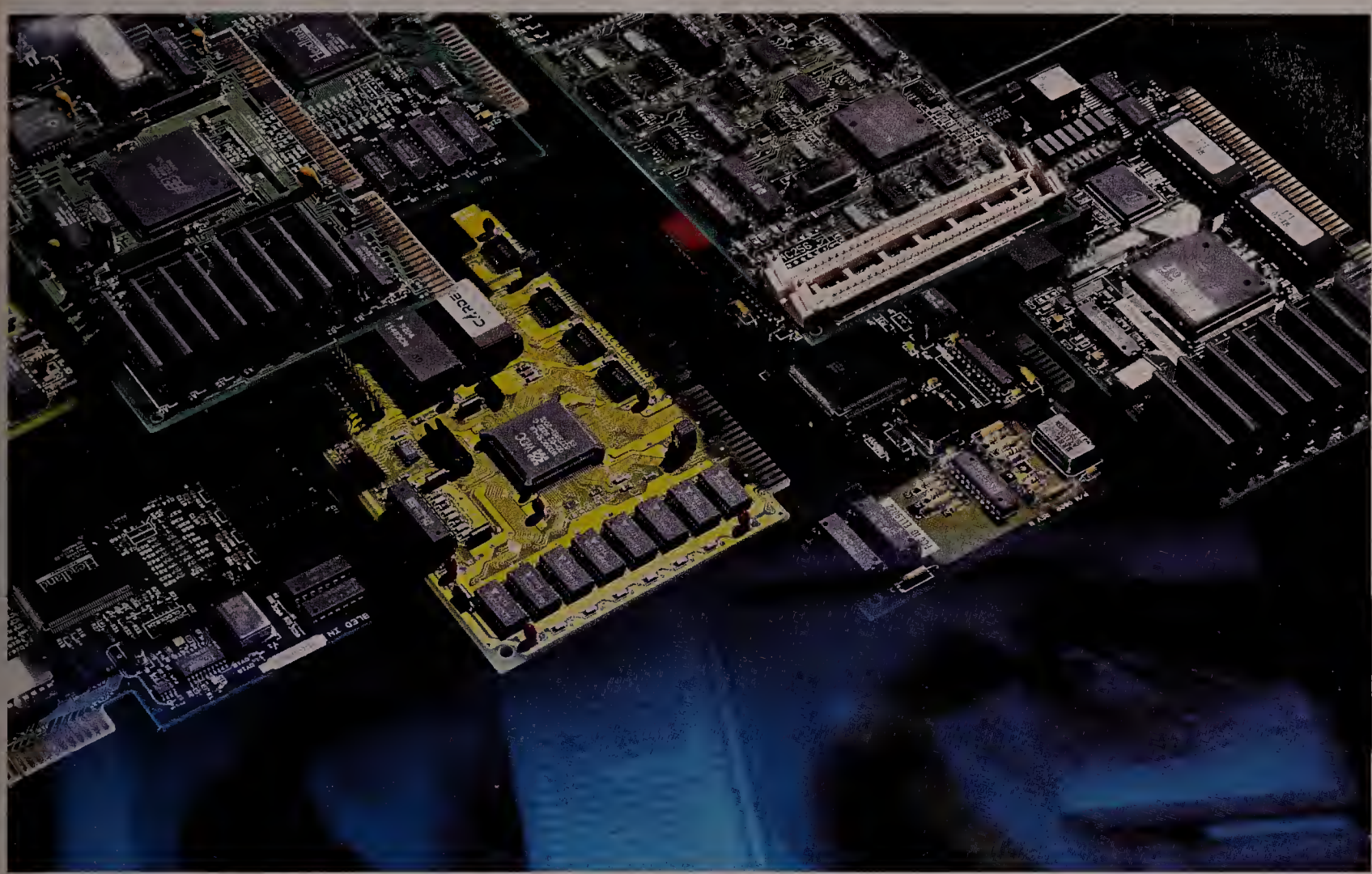


Fast Video For Less

Is Windows slowing your system to a crawl? Double or triple your speed for under $400 with one of these 95 graphics accelerator boards–and get high resolution, flicker-free performance and up to 16 million colors in the bargain.

Want to speed up your PC? If you're a *Windows* or CAD user, look no further than your video board. This buyers' guide offers nearly 100 graphics-accelerating video boards (graphics accelerators for short), list priced under $400. All products listed here feature the latest silicon secrets for speeding up graphics and delivering flicker-free displays at high resolutions, and they come with high-resolution drivers designed with *Windows* and CAD users in mind. Even better, the street price on these babies will be substantially less than the suggested retail price—anywhere from 20 to 40 percent less.

Speed becomes a big issue each time you want your screen to handle more information—usually in the form of more colors or pixels. Along with a video board, you need two things to take advantage of beyond-VGA resolutions: a driver for the application you want to use and a monitor that can handle the enhanced image (see "Best Monitors for $1000" in this issue). Even if 800 by 600 resolution seems adequate for now, it's wise to prepare for the future. You may want a larger monitor someday, and the higher resolution of 1024 by 768 or 1280 by 1024 will let you fit more windows, display more spreadsheet cells, or show more of your document on screen. Nearly all the accelerator boards in our buyers' guide support 1280 by 1024, the resolution of choice for 19- to 21-inch monitors.

As these boards add more color modes and acceleration techniques, the list of technical specs on your shopping checklist may seem unwieldy. This guide will help you make an informed purchase by identifying critical areas to consider: speed,

by Scott Dunn

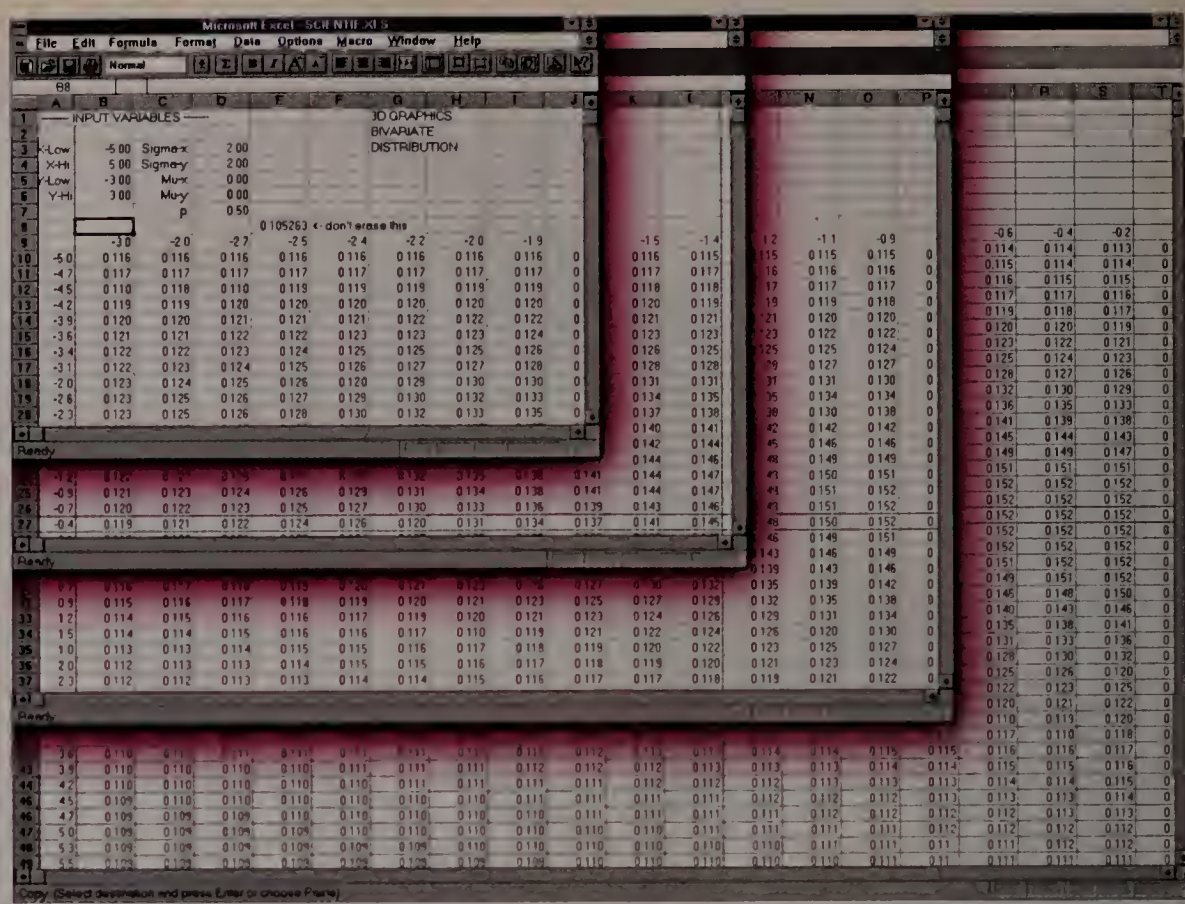
PHILLIP KAAKE

refresh rates, resolution, color, memory, drivers, and monitor compatibility.

Think Fast

Stepping up to a faster video board won't change the fundamental throughput of your computer: Loading applications, saving and printing documents, or calculating spreadsheets will take about the same amount of time as they do now. But graphics accelerators can speed up many *Windows* operations, including opening, closing, and moving windows and dialog boxes, and scrolling through text or spreadsheet cells. A fast video board can breathe new life into an old 386 or even a 286, letting you postpone pricier system upgrades.

The secret to video oomph lies in a flock of new graphics accelerator chips with such catchy names as the 86C911 from S3, the Weitek 5186 from Weitek, and the WD 90C31 from Western Digital. These chips take some of the load off the CPU by handling basic graphics functions. To draw a line, for example, your CPU no longer has to define each pixel. It just tells the video board the line's beginning and end points, and the accelerator chip does the rest.



If you've got a big enough monitor, higher resolutions are great for getting the big picture. Here's the same worksheet at four resolutions: VGA, 800 by 600, 1024 by 768, and 1280 by 1024.

One board here, the AT-1024 from Enertronics Research, uses the TI 34010 from Texas Instruments, a fully programmable graphics coprocessor. Boards built around this chip have a reputation for being fast, expensive, and finicky to install. Also speedy are boards

Installation: Not Yet Plug and Play

In some future, perfect world, you'll be able to install a video board by popping it into a slot and running some easy menu-driven installation software. But for the time being, the world of computer clones and configurations is so diverse, a one-size-fits-all approach is still a fantasy. Consider the following installation issues.

Jumps and DIPs

Many video boards require you to adjust DIP switches to enable different refresh rates for various resolutions. You may need to change other settings by moving the connector caps on tiny "jumper" pins. You may have to change the jumper connectors to ensure motherboard compatibility, avoid conflicts with interrupt settings used by other applications, or accommodate more memory chips.

Just Passing Through

Since these video boards were bred for super VGA and higher, they don't all have built-in VGA capability. Those that lack it support "VGA pass through," which requires you to connect the new video board's cable to your existing VGA controller. If the cable isn't long enough, you may have to rearrange your existing boards. Make sure the cable includes connectors that will fit your existing VGA board or motherboard connector.

Backseat Driver

Then there's the software component. Most installation programs take the tack of walking you through the process with an easy menu. But installing for customized setups can become tricky. Your board may have one utility for setting the refresh rate for each resolution and another one for installing drivers for individual programs. If you install *Windows* drivers for resolutions you haven't used before, you may be prompted for your original *Windows* disks to get the proper system fonts. If you're the type who keeps multiple copies of *Windows*' SYSTEM.INI file, be sure to update each copy with the information added by the driver installation routine. Some boards, like Diamond's SpeedStar 24x or Orchid's Fahrenheit 1280, avoid this work-around by including *Windows* utilities for switching between video resolutions and color levels.

TIGA by the Tail

If you install a board that uses the Texas Instruments coprocessor TI34010, you may need to install TIGA (Texas Instruments Graphics Architecture) software that lets the coprocessor communicate with your computer's microprocessor. If you're lucky, the installation utility will add the necessary environment variable to your AUTOEXEC.BAT file. Otherwise, you may have to add it yourself or tweak its settings to fit your particular configuration. Remember the old adage: If all else fails, read the directions.

—Scott Dunn

Local-Bus Video: Paving That Dusty Old I/O Path

If today's 486 systems are the superhighways of personal computing, the ISA, EISA, or MCA bus serving your graphics monitor is a city street. The I/O bus sitting between your graphics board and processor generally jogs along at 8 or 10 MHz whether your PC is a 12-MHz 286 or a 50-MHz 486. Graphical environments such as *Windows*, which proffer a wide palette of colors and a host of pixels, often run afoul of the I/O bottleneck. Graphics accelerator boards speed things up by moving work off the processor, but they're often left hungry for data by the slow clock speed and narrow 16-bit data path of the ISA I/O bus. Even Micro Channel and EISA buses are fettered by 10-MHz and 8-MHz clock speeds.

A New Data Path

The obvious solution is to use an alternate path to move data from the processor to the graphics adapter: the processor's local bus. It's hardly a new idea. The processor's local bus has been used to speed access to system RAM since 10-MHz and 12-MHz 286 processors entered the market. Today, some six years later, several companies and organizations are applying a similar solution to video.

The local bus acts as a direct access ramp to your processor, bypassing the surface streets with a fast, wide stretch of highway that directly connects your graphics adapter to your processor. This method lets your video board run at clock speed—currently as high as 50 MHz—and employ a full 32-bit data path, delivering a potential 400 percent increase in video performance over boards not using the local bus. The catch? The local bus requires motherboards and peripheral cards that are designed to use it.

The local bus first reached the market with systems from vendors such as Hewlett-Packard, Dell, and NEC. While these PCs offer blazing speed and a wide data path, they're either proprietary motherboard implementations that can't be upgraded, or require proprietary slots without much third-party support.

Enter VESA, the Video Electronics Standards Association, which formed a committee of over 50 companies, from processor maker AMD to video chip maker Tseng Labs, to establish a standard local-bus architecture. The standard, VESA Local Bus (VL-Bus), ensures that every VL-Bus board works in every VL-Bus slot. And with VL-Bus supporting three slots, high-demand peripherals such as disk controllers and LAN cards will also be able to run off the local bus.

But building the shiny new local bus is only half the battle. Up to now, most local-bus video systems have failed to outshine traditional accelerators because the boards and chips serving them were designed around the 16-bit, 8-MHz bus.

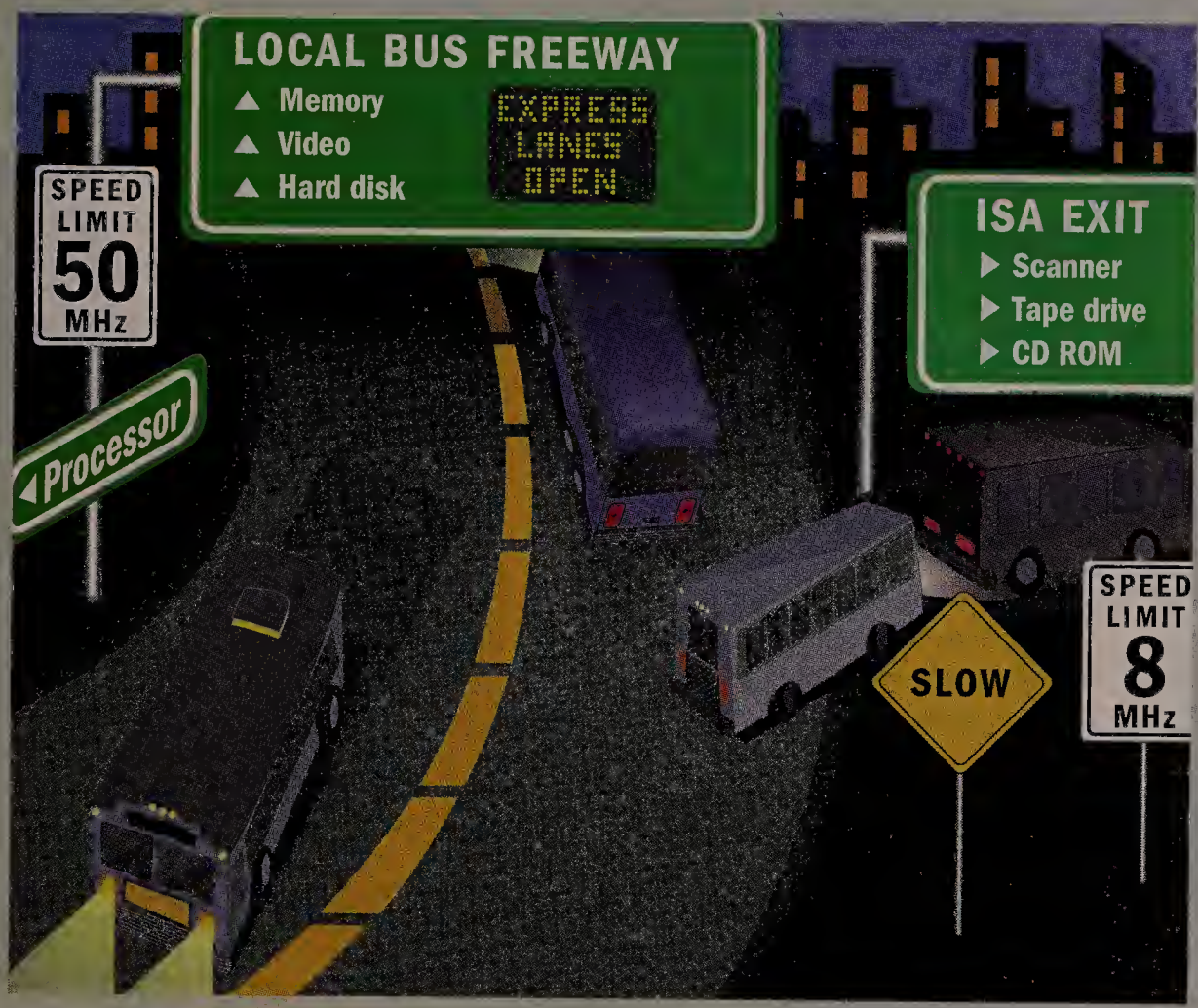
With its standard connection and wide vendor backing, however, VL-Bus could be a powerful incentive for chip makers to build optimized products. And with VL-Bus–ready systems estimated at just $30 to $70 more than standard ISA designs, there could soon be a lot of empty slots to fill.

The local bus, though, still has troubles. Clock speeds above 33 MHz produce signal problems that limit the number of peripherals supported—thus VESA's three-slot limit. And local buses designed for the 32-bit 486 may be unable to take advantage of upcoming 64-bit systems without serious redesign.

Intel moved to resolve some of these problems with its Peripheral Component Interface (PCI). Unlike the VL-Bus, PCI will act as an interposing control layer between the processor bus and peripheral. By running peripherals independent of the system clock, PCI will support ten peripherals at 33 MHz while streamlining data transfers for high throughputs. But Intel is banking on the future, when PCI's protocols will manage the 64-bit data path of Intel's upcoming P5 processor, and help reduce the complexity of peripheral circuitry needed to handle it.

The road to enhanced video performance has finally been paved. Now hop on the local bus and enjoy the ride.

—Michael Desmond



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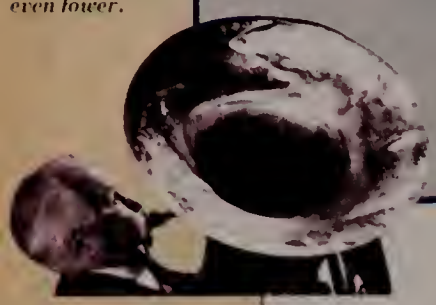

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Notebook	CPU	RAM (MBs)	HD (MBs)	Battery Life (Hrs)	Price
386SX/20	Intel 80386SX-20 MHz Optional 80387SX Last years' model, 6.5 lbs (while supplies last)	2 standard, 16 max	60	1.5+	$999† $37/mo*
386SXL/25	386 SXL-25 MHz Optional 80387SX This years' model, 5.5 lbs (while supplies last)	2 standard, 4 & 6 options	60	3.5+	$1,399 $52/mo*
386SXL/25	386SXL-25 MHz, Optional 80387SX	2 standard, 4 & 6 options	80 (more MBs!)	3.5+	$1,599 $59/mo*
386SL/25	Intel 80386SL-25 MHz, 64 K CPU cache Advanced SL power mgm't, Optional 80387SX co-processor	as above	80	3.5+	$1,799 $67/mo*
486SX/25	Intel 80486SX-25 MHz, Built-in 8K CPU cache	4 standard, 8 & 20 options	80	2.5+	$1,999 $74/mo*
486DX/33	Intel 80486DX-33 MHz, Built-in 8K CPU cache	as above	130	2.5+	$2,899 $107/mo*

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- Internal FAX/Modem: 9600 bps send/receive fax; 2400 bps modem; inc. WinFax and Quicklink Software.
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Desktop	CPU	RAM (MBs)	HD (MBs)	Floppy	Display	Price
386DX/33	Intel 80386DX–33 MHz	1 standard 32 max	40	1.2 or 1.44	16 bit SVGA card, 14" 640x480 VGA Color Monitor	$849 ** $32/mo*
386DX/33 or 486SX/25	Intel 80386DX–33 MHz or Intel 80486SX–25 MHz, w/built-in 8K CPU cache	2 standard 32 max	80	as above	as above	$999 $37/mo*
486SX/25	Intel 80486SX–25 MHz Built-in 8K CPU cache	as above	80	1.2 & 1.44	16 bit SVGA card, 14" 1024 x 768 SVGA Color Monitor	$1,199 $44/mo*
386DX/33 CACHE	Intel 80386DX–33 MHz 64K CPU cache	4 standard 32 max	120	as above	16 bit SVGA card & Hi-Color Support 14" 1024 x 768 SVGA, .28 Interlaced Color Monitor	$1,399 $52/mo*
486SX/33	Intel 80486SX–33 MHz 8K CPU cache	as above	120	as above	as above	$1,499 $56/mo*
486DX/33 CACHE	Intel 80486DX–33 MHz 128K CPU cache	as above	120	as above	16 bit SVGA card, 1MB Video RAM & Hi-Color Support, 14" 1024 x 768 SVGA Non-Interlaced Multisync Color Monitor	$1,799 $67/mo*
486DX/50 CACHE	Intel 80486DX–50 MHz 128K CPU cache, True 50 MHz CPU	as above	120	as above	as above	$1,999 $74/mo*
486DX2/66 CACHE	Intel 80486DX2–66 MHz, 128K CPU cache New Double Clock CPU	8 standard 32 max	200	as above	16 bit SVGA, Superfast Windows, Accelerator card, 1MB RAM, 14" 1024 x 768 SVGA Non-Interlaced Multisync Color Monitor	$2,499 $93/mo*

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Low-Cost Video Accelerator Boards

● = Yes ○ = No n/a = not available

Company	Product	Video chip	List price	DRAM	VRAM	Accelerates at all resolutions
AAMAZING TECHNOLOGIES	VGA1000	AVGA3	$179	1MB		●
ACTIX	GraphicsEngine 32	S3 86C801	$199	1MB		●
	GraphicsEngine	S3 86C924	$299		1MB	○ [4]
	GraphicsEngine 1280TC	S3 86C924	$359		1MB	○ [4]
	GraphicsEngine 1280	S3 86C924	$399		1MB	○ [4]
ADD-ON AMERICA	Renoir Ultra-SVGA Card	ET 4000	$269	1MB		●
	Renoir NT Windows Accelerator	S3 86C911	$299		1MB	●
ADVANCED INTEGRATION RESEARCH	BAV2H	S3 86C911	$299		1MB	●
	BAV2EH	S3 86C911	$349		1MB	●
AEP COMPUTER SYSTEMS DIVISION	Video Time Machine	ALG2101	$195	1MB		●
ATI TECHNOLOGIES	Graphics Ultra+	ATI 68800	$399	1MB		●
AVTECH	GraphTek 1	Weitek 5286	$145		1MB	●
	GraphTek 2+	Weitek 5286	$199		512K	●
	GraphTek 2+	Weitek 5286	$275		1MB	●
BOCA RESEARCH	SXVGAX5 SuperVGA	Cirrus Logic CL-GD5422	$175	512K		●
	SXVGAX1 SuperVGA	Cirrus Logic CL-GD5422	$210	1MB		●
	SXVGAX2 Super X VGA	Cirrus Logic CL-GD5422	$235	1MB		●
CACHE COMPUTERS	Lynx VGA, Model 336	S3 86C911	$395		1MB	●
CARDINAL TECHNOLOGIES	VGA900	S3 86C911	$349		512K	●
	VGA900	S3 86C911	$399		1MB	●
CELERITE GRAPHICS	Galaxy 2000 Hi Color	P2000	$129	1MB		●
	Galaxy 2000 Hi Color	P2000	$169	2MB		●
	Galaxy 2000 True Color	P2000	$139	1MB		○ [4]
	Galaxy 2000 True Color	P2000	$179	2MB		○ [4]
CHEM	WinPro 1280	P2000	$150	1MB		●
	WinPro 1280	P2000	$180	2MB		●
	WinPro 1280 (high color)	P2000	$190	2MB		●
	WinStar	Cirrus Logic 5422	$115	2MB		●
	Ninja Turbo 32	ET4000/W32	$285	1MB		●
	Ninja Turbo 32	ET4000/W32	$395	4MB		●
COMPUADD COMPUTER	Windows Accelerator	WD 90C31	$239	1MB		●
CSS LABORATORIES	MaxGraphics/16	S3 86C924	$255		512K	●
CUI	Turbo Windows Accelerator	S3 86C911	$322		1MB	●
DESKTOP COMPUTING	Desktop AVGA	AVGA3	$199	1MB		●
DFI	VG-8000W	WD 90C31	$179	1MB		●
	VG-8000WH	WD 90C31	$199	1MB		●
DIAMOND COMPUTER SYSTEMS	SpeedStar 24X	WD 90C31	$249	1MB		●
	Stealth VRAM	S3 86C924	$399		1MB	●
EDGE TECHNOLOGIES	D24 BitBlaster	Cirrus Logic CL-GD5422	$99	1MB		●
	V24 BitBlaster	S3 86C924	$199		1MB	●
ENERTRONICS RESEARCH	AT-1024	TI 34010	$399	512K	1MB	●
EVEREX SYSTEMS	Vision VRAM Accelerator	S3 86C924	$399		1MB	●
EVERSHINE TECHNOLOGY	PD2W	WD 90C31	$245	1MB		●
	VEGA/5000	Weitek 5186	$249		1MB	●
	ShineStar/S311	S3 86C911	$299		1MB	●
FOCUS INFORMATION SYSTEMS	2theMax VGA GUI2000	Avance Logic	$220	1MB		●
GENERAL BUSINESS MACHINES	Storm 1280i	S3 86C911	$295		1MB	●
	Storm 1280/16	S3 86C924	$395		1MB	●
GENOA SYSTEMS	WindowsVGA Model 8800	S3 86C911	$299		1MB	○ [7]
	WindowsVGA Model 8860	S3 86C911	$319		1MB	○ [7]

[1] Noninterlaced.
[2] Suite includes drivers for Windows, AutoCAD, 1-2-3, WordPerfect, and GEM.
[3] Windows and AutoCAD only.
[4] Doesn't accelerate VGA at 16.8 million colors.
[5] 1280 by 960 at 64 Hz noninterlaced.
[6] Does not support GEM.

MUM COLORS AT EACH RESOLUTION				REFRESH										
VGA	800 by 600	1024 by 768	1280 by 1024	VGA/800 by 600/1024 by 768 [1]	1280 by 1024	VGA passthrough	Driver suite [2]	Menu installation	Warranty (years)	Toll-free tech support	Weekly hours	BBS	Fax	Reader service number
1 million	65,536	256	16	72/72/70	43.5	○	○ [3]	●	1	○	40	○	●	686
16.8 million	65,536	256	16	72/72/70	60 [1]	●	●	●	1	○	47.5	●	●	687
32,768	256	256	16	72/72/72	43.5 [5]	●	●	●	1	○	47.5	●	●	687
16.8 million	256	256	16	72/72/72	60 [1,5]	●	●	●	1	○	47.5	●	●	687
32,768	256	256	16	72/72/72	60 [1,5]	●	●	●	1	○	47.5	●	●	687
16.8 million	65,536	256	16	87/70/72	43.5	●	●	○	5	●	45	●	●	688
65,536	65,536	256	16	77/76/71	45	●	●	●	5	●	45	●	●	688
16.8 million	256	256	16	72/72/70	43	●	●	○	1	●	47.5	●	●	689
16.8 million	256	256	16	72/72/70	43	●	●	○	1	●	47.5	●	●	689
65,536	65,536	256	16	70/72/70	45	●	●	●	1	○	40	●	●	690
16.8 million	65,536	256	16	76/72/76	74 [1]	●	●	●	5		dealer	●	●	691
16.8 million	32,768	256	16	76/75/76	43.5	●	●	●	5	●	168	●	●	692
16.8 million	32,768	256	16	76/75/76	43.5	●	●	●	5	●	168	●	●	692
16.8 million	32,768	256	16	76/75/76	43.5	●	●	●	5	●	168	●	●	692
256	256	16	n/a	70/72/70	n/a	●	●	●	5	○	50	●	●	693
256	256	256	16	70/72/70	43.5	●	●	●	5	○	50	●	●	693
16.8 million	65,536	256	16	70/72/70	43.5	○	●	●	5	○	50	●	●	693
32,768	256	256	16	72/72/72	45	●	●	○	2	○	50	●	●	694
65,536	256	256	16	72/72/72	45	●	●	●	1	○	40	●	●	695
65,536	256	256	16	72/72/72	45	●	●	●	1	○	40	●	●	695
65,536	65,536	256	256	72/72/70	42	●	●	●	1	●	70	●	●	696
65,536	65,536	256	256	72/72/70	42	●	●	●	1	●	70	●	●	696
16.8 million	65,536	256	256	72/72/70	42	●	●	●	1	●	70	●	●	696
16.8 million	65,536	256	256	72/72/70	42	●	●	●	1	●	70	●	●	696
32,768	32,768	256	256	72/72/70	43	●	●	●	2	○	45	○	●	697
65,536	32,768	256	16	72/72/70	43	●	●	●	2	○	45	○	●	697
65,536	65,536	256	256	72/72/70	43	●	●	●	2	○	45	○	●	697
16.8 million	65,536	65,536	256	72/72/70	43	●	●	●	3	○	45	○	●	697
16.8 million	16.8 million	65,536	16	72/72/70	70 [1]	●	●	●	3	○	45	○	●	697
16.8 million	16.8 million	65,536	256	72/72/70	70 [1]	●	●	●	3	○	45	○	●	697
256	256	256	n/a	n/a/72/72	n/a	○	●	●	1	●	168	●	●	698
65,536	16	16	n/a	70/70/70	70 [1]	●	○ [6]	○	1.5	●		●	●	699
65,536	32,768	256	16	72/72/72	72 [1]	●	●	●	2	●	45	●	●	700
16.8 million	65,536	256	16	72/72/70	43.5	●	●	●	1	○	45	●	●	701
256	256	256	16	72/72/72	43.5	●	○ [6]	●	1	○	47.5	●	●	702
32,768	32,768	32,768	256	72/72/72	43.5	●	○ [6]	●	1	○	47.5	●	●	702
16.8 million	32,768	256	16	72/72/72	43.5	●	○ [6]	●	5	○	45	●	●	703
16.8 million	256	256	16	72/72/70	45	●	●	●	5	○	45	●	●	703
16.8 million	65,536	256	16	72/72/70	43.5	●	●	●	1	●	66	●	●	704
16.8 million	256	256	16	72/72/72	60 [1]	●	●	●	1	●	66	●	●	704
16	256	256	16	84/80/80	60 [1]	○	●	●	2	○	40	○	●	705
65,536	256	256	16	72/72/70	60 [1]	○	●	●	2	●	80	●	●	706
32,768	256	256	n/a	70/72/70	n/a	●	○ [6]	●	1	○	45	○	●	707
32,768	256	256	16	77/75/73	43.5	●	●	●	1	○	45	○	●	707
32,768	256	256	16	73/72/70	45	●	○ [6]	●	1	●	45	○	●	707
65,536	65,536	256	16	60/72/70	45	●	●	●	2	○	45	●	●	708
32,768	256	256	16	80/75/72	43	●	●	●	5	○	50	●	●	709
32,768	32,768	256	16	80/75/72	60 [1]	●	●	●	5	○	50	●	●	709
32,768	256	256	16	72/72/70	43	●	●	○	2	○	35	●	●	710
32,768	256	256	16	72/72/70	43	●	●	○	2	○	35	●	●	710

[7] Doesn't accelerate VGA.

TABLE CONTINUES ON FOLLOWING PAGES

built on a chip from S3—either the 86C911 or the newer 86C924, which supports 16.8 million colors. S3 users should see particular gains in word processing and spreadsheet applications, though not necessarily in presentation graphics programs (see "Fast Video Boards for Windows," March 1992).

Refresh Yourself

Many people notice a distinct flicker or image vibration on old or inexpensive monitors—especially with the white backgrounds and light colors common to *Windows*. That's because the *refresh rate*—the number of times per second (Hz) the screen is repainted—is too low; like a nickelodeon, it's displaying too few screens per second for comfortable viewing. Refresh rate is controlled by the video board. If you use a 14-inch monitor, a refresh rate of 60 Hz may be sufficient. But if you think you'll be stepping up to a bigger screen (and higher resolution), aim for 70 or 72 Hz. Remember that the higher the resolution you demand, the harder it is to find a board with a brisk refresh rate. Although all these boards have refresh rates of at least 70 Hz at 1024 by 768, many support refresh rates of only 43.5 or 60 Hz at 1280 by 1024, slow enough to produce eyestrain. If there's a giant monitor in your future, look for a refresh rate of at least 70 Hz at 1280 by 1024. And consider your physical environment. The more fluorescent lighting or sunlight your office has, the more you'll want a high refresh rate.

Low-Cost Video Accelerator Boards *continued*

● = Yes ○ = No n/a = not available

Company	Product	Video chip	List price	DRAM	VRAM	Accelerates at all resolutions
HAUPPAUGE COMPUTER WORKS	GUIacc-01	S3 B6C911/86C924	$395		1MB	●
HELIO COMPUTERS	TurboColor 1280-16	S3 B6C924	$399		1MB	●
HERCULES COMPUTER TECHNOLOGY	Graphite Card	IIT AGX014	$399		1MB	●
MICRO EXPRESS	ME Ultimate Accelerator Card	S3 B6C911	$245		1MB	●
MICRO-LABS	Ultimate TrueColor/XL	ET4000/W32	$199	1MB		●
	Ultimate TrueColor/XL4	ET4000/W32	$249	2MB		●
	Ultimate TrueColor/XL4	ET4000/W32	$329	4MB		●
MISSION TECHNOLOGY	Mission Windows Accelerator	NCR 77C22	$149	1MB		●
	Mission V 31 H Accelerator	WD 90C31	$175	1MB		●
	Mission Windows Accelerator	NCR 77C22	$189	2MB		●
	Mission V 60 HX	S3 86C911	$299		1MB	●
NATIONAL DESIGN	Volante AT600 Plus	S3 86C924	$395		1MB	○
	Warp 10	S3 B6C801	$299	1MB		●
ORCHID TECHNOLOGY	Fahrenheit 12B0	S3 B6C924	$329		512K	○[5]
	Fahrenheit 12B0	S3 B6C924	$399		1MB	○[5]
PIXEL ENGINEERING	WinPrime	P2000	$155	1MB		●
	WinPrime	P2000	$185	2MB		●
	Total Truecolor Accel	Cirrus 5426	$250	2MB		●
	ProWinAccl	ET4000/W32	$285	1MB		●
	ProWinAccl	ET4000/W32	$295	1MB		●
	Pixel Turbo Windows Accelerator	S3 B6C911	$340		1MB	●
	Pixel Turbo Windows Accelerator	S3 B6C911	$355		1MB	●
	ProWinAccl	ET4000/W32	$395	4MB		●
PRISM IMAGING SYSTEMS	Prism Accelerator X-VGA	Avance Logic	$149	1MB		●
SPEA/VIDEO SEVEN	Win-VGA	HT 216	$159	512K		●
	Win-VGA	HT 216	$189	1MB		●
TANGRAM TECHNOLOGY	TANXcell – GUI	Avance Logic	$160	1MB		●
VIDTECH MICROSYSTEMS	WinMax	Weitek 5186	$199		512K	●
	WinMax HiColor	Weitek 5186	$299		1MB	●
VISTRO COMPUTERS	BV5	Weitek 5186	$345		1MB	●
VX TECHNOLOGIES	XTC 2000	P2000	$399	2MB		●
WESTERN DIGITAL	Paradise Accelerator Card for Windows	WD 90C31	$249	1MB		●
YOUNG MICROSYSTEMS	WinDraw II	Weitek 5086	$190[6]		512K	●

[1] Noninterlaced.
[2] Suite includes drivers for Windows, AutoCAD, 1-2-3, WordPerfect, and GEM.
[3] 1024 by 1024 at 256 colors.
[4] Does not support GEM.
[5] Doesn't accelerate VGA at 16.8 million colors.
[6] Estimated street price.

Erase the Interlace

Another source of monitor flicker is *interlacing*. In this scheme, your video board paints the top line on your monitor, then paints the third, then the fifth, and so on down the screen. It then returns to the top to fill in the even-numbered lines, hopefully before you notice the odd lines fading. If you think 60-Hz flicker is bad, avoid interlacing at all costs.

All the boards in this buyers' guide support noninterlaced displays at resolutions up to 1024 by 768. A few boards—including entries from Chem, CSS, CUI, Hauppauge, Helio, Micro-Labs, Pixel Engineering, and Prism Imaging—support at least 70-Hz noninterlaced refresh rates at 1280 by 1024.

Color Your World

Like resolution, more colors means more data to handle and a bigger drain on video performance. Thanks to the new accelerator chips, you can afford a colorful splurge without a huge price and performance loss (see "Champing at the 24 Bit"). The video boards here offer a wide range of color options from 4-bit (16 colors) to 24-bit (16.8 million colors).

More 24-bit "true color" boards—offering 16.8 million colors—are available now than ever before. Most of those listed here support this color density only at VGA resolutions, but two product lines offer true color in super-VGA resolution: CHEM's Ninja Turbo 32 series boards and Pixel Engineering's ProWinACCL boards.

MAXIMUM COLORS AT EACH RESOLUTION				REFRESH										
VGA	800 by 600	1024 by 768	1280 by 1024	VGA/800 by 600/1024 by 768 [1]	1280 by 1024	VGA passthrough	Driver suite [2]	Menu installation	Warranty (years)	Toll-free tech support	Weekly hours	BBS	Fax	Reader service number
65,536	256	256	16	73/73/70	70 [1]	●	●	○	1	○	50	●	●	711
32,768	256	256	16 [3]	72/72/72	70 [1]	●	●	●	5	●	45	●	●	712
32,768	32,768	256	16	90/90/76	45	●	○ [4]	●	2	●	50	●	●	713
256	256	256	16	72/72/70	43.5	●	●	●	7	●	168	○	●	714
16.8 million	65,536	256	16	72/72/70	43.5	○	●	○	3	○	54	●	●	715
16.8 million	65,536	65,536	256	72/72/70	70	○	●	○	3	○	54	●	●	715
16.8 million	65,536	65,536	256	72/72/70	70 [1]	○	●	○	3	○	54	●	●	715
65,536	65,536	256	16	72/72/70	43.5	●	●	●	1	○	45	○	●	716
32,768	32,768	256	16	72/72/70	43.5	●	○ [4]	●	1	○	45	○	●	716
65,536	65,536	256	256	72/72/70	43.5	●	●	●	1	○	45	○	●	716
65,536	65,536	256	16	72/72/70	43.5	●	○ [4]	●	1	○	45	○	●	716
16.8 million	256	256	16	72/72/72	60 [1]	○	●	●	lifetime	●	45	●	●	717
16.8 million	256	256	16	72/72/70	44	○	●	●	lifetime	●	45	●	●	717
16.8 million	256	256	16	72/72/70	48	●	●	●	4	●	50	●	●	718
16.8 million	256	256	16	72/72/70	48	●	●	●	4	●	50	●	●	718
32,768	32,768	256	256	72/72/70	43	●	●	●	3	○	49	○	●	719
32,768	32,768	256	256	72/72/70	43	●	●	●	3	○	49	○	●	719
16.8 million	65,536	65,536	32,768	72/72/70	43	●	●	●	5	○	49	○	●	719
16.8 million	16.8 million	65,536	32,768	72/72/70	70 [1]	●	●	●	5	○	49	○	●	719
16.8 million	16.8 million	65,536	32,768	72/72/70	70 [1]	●	●	●	5	○	49	○	●	719
16.8 million	32,768	256	16	72/72/70	43	○	●	●	5	○	49	○	●	719
16.8 million	32,768	256	16	72/72/70	43	○	●	●	5	○	49	○	●	719
16.8 million	16.8 million	65,536	32,768	72/72/70	70 [1]	●	●	●	5	○	49	○	●	719
65,536	65,536	256	16	72/72/76	70 [1]	●	●	●	3	○	40	●	●	720
256	256	16	n/a	60/70/72	44	○	●	●	7	●	40	●	●	721
256	256	256	n/a	60/70/72	44	○	●	●	7	●	40	●	●	721
65,536	65,536	256	16	60/72/70	45	○	●	●	5	○	40	○	○	722
256	256	16	n/a	77/75/74	n/a	n/a	●	●	5	●	45	●	●	723
32,768	32,768	256	n/a	77/75/74	n/a	n/a	●	●	5	●	45	●	●	723
32,768	32,768	256	n/a	72/72/72	n/a	○	○ [4]	●	5	○	45	○	●	724
16.8 million	65,536	256	256	76/72/72	43	●	●	●	2	●	40	●	●	725
32,768	32,768	256	16	60/72/72	43.5	●	○ [4]	●	3	○	40	●	●	726
256	16	16	n/a	n/a/n/a/72	n/a	○	●	●	1	○	45	○	●	808

For more information about all products in this table, circle reader service no. 903.

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- 486SX25
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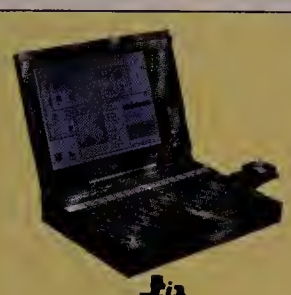

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Circle 180 on reader service card

Before you plunge into the color quagmire, however, evaluate your color needs. If your work consists primarily of spreadsheets, word processing, or databases, don't worry about getting a board capable of displaying 32,768 or more colors. In many cases, extra colors will slow you down. On the other hand, if you create photo-realistic CAD renderings, manage color photo databases, or work in full-color publishing, the extra colors are worth the higher price. And if you do opt for a true-color board, check to see which manufacturers offer memory upgrades—and at what price.

Remember Memory

All these boards have a minimum 512K of RAM. This amount should suffice for most business applications in resolutions up to 1024 by 768 in 16 colors. But if your applications support 15- or 16-bit "high color" (32,768 or 65,536 colors), or if you want the high resolution of 1280 by 1024, buy at least 1MB of video memory.

Until recently most video controllers included DRAM—dynamic RAM—on chips with a single port through which your CPU reads and writes data. Some vendors have opted instead for VRAM—video RAM—memory chips with dual ports that permit simultaneous reading and writing. As a rule, VRAM is faster than DRAM. (Using the term *video RAM* for VRAM is unfortunately confusing, since a video board's memory, whether DRAM or VRAM, is also commonly referred to as video RAM.)

Designated Driver

Your graphics accelerator is only as good as the application-specific software drivers that ship with it. A well-written driver can mean the difference between video performance that is nimble or numbing. All the boards here ship with drivers for *Windows* and *AutoCAD;* all but Aamazing Technologies' VGA1000 also have *1-2-3* and *WordPerfect* drivers; and most include a driver for GEM. Some boards throw in drivers for *Microsoft Word*, assorted CAD packages, and other DOS applications. Check with the manufacturer to make sure the board you buy has all the drivers you need.

You'll also want a board with driver upgrades available through a BBS or the mail, since board makers need to release new drivers every time a major application is upgraded. Use the accompanying table to check for the guarantee and support policy that works best for you.

Monitor the Situation

The best board won't do you a bit of good if your monitor can't take advantage of its features. For example, you could buy a video board that supports a zippy, noninter-

Memory Requirements: The Cost of Color

	VGA	Super VGA	1024 by 768	1280 by 1024
16 colors	512K	512K	512K	1MB
256 colors	1MB	1MB	1MB	2MB
32,768 colors	1MB	1MB	2MB	2MB+
16,777,216 colors	1MB	2MB	2MB+	2MB+

Champing at the 24 Bit

True-color technology—also called 24-bit color—has been available on the Macintosh for some time but was not an issue in the PC world until recently. The acceptance of *Windows*, the emergence of affordable graphics accelerators with 24-bit capability, and the sudden proliferation of software packages that can handle 16.8 million colors, however, promise to make true color a big deal on the PC.

True color (and to a lesser extent 15- or 16-bit high color, which supports either 32,768 or 65,536 colors) adds smoother gradients and photo-realistic quality to your presentations, scanned images, and color publishing previews.

As with all good things, true color comes at a price. Because there are no standard BIOS calls or drivers for 24-bit color, drivers must be developed by each board manufacturer, some of whom complain that Microsoft has not adequately defined 24-bit color for *Windows'* Graphical Device Interface (GDI). Imperfect drivers can result in weird displays or even system crashes.

Needed: 24-Bit Apps

To get the most out of true and high color, you need applications programmed to support them. Currently, only a relatively small number of graphics, publishing, and CAD programs meet this need, and the number of applications and graphics file formats that support 15- and 16-bit high color are rarer still.

Because of the additional information (in the form of more colors) your computer must handle, true color also exacts a huge speed penalty from your video system. Most low-cost 24-bit video boards support true color only at VGA (640 by 480) resolution, keeping the impact to a minimum.

Last but not least, true-color files are dramatically larger than comparable 8-bit images. A 24-bit, 640 by 480 screen shot can occupy almost 1MB of hard disk space; be prepared to multiply that figure by 20, 50, or more for large scans and complex graphics such as architectural drawings. Even if the storage space is available, you may find yourself checking your watch each time you open or save such a file.

As true-color applications become more widely available and compression schemes (such as JPEG) continue to develop, 24-bit color will no doubt increase in usefulness and popularity. Now, it's best for graphics professionals.

The proliferation of software that can handle 16.8 million colors promises to make true color a big deal on the PC.

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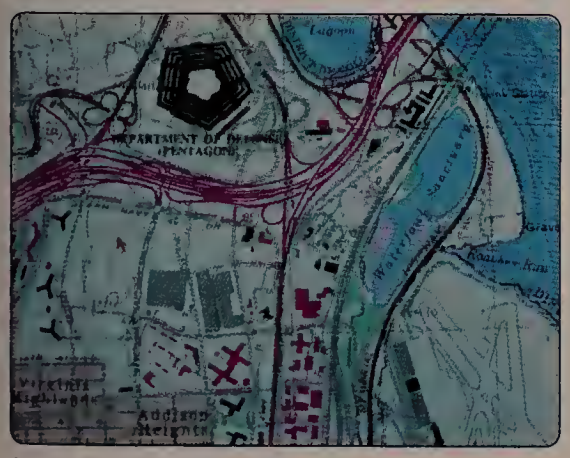

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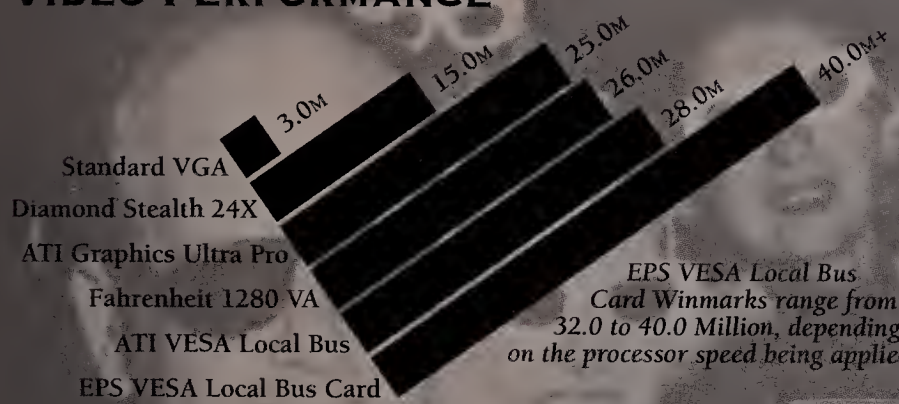

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Circle 171 on reader service card

laced refresh rate at ultra-high resolutions, only to discover that your monitor requires a lower or interlaced rate (or both) at the resolution you want. If you plan to upgrade to a new monitor in the future, get a video board that allows expansion. When shopping for a monitor, be sure it's compatible with the best features of your video board.

Scott Dunn is a contributing editor and Michael Desmond an editorial intern for PC World.

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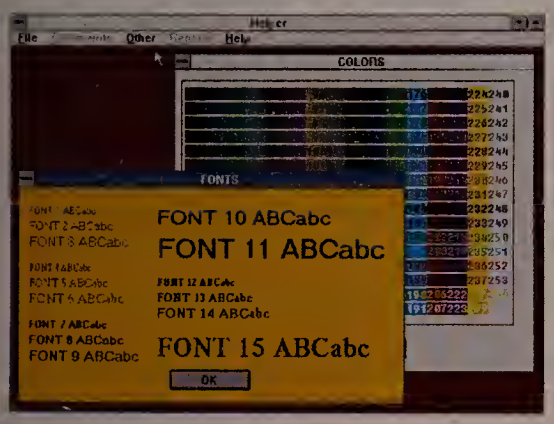

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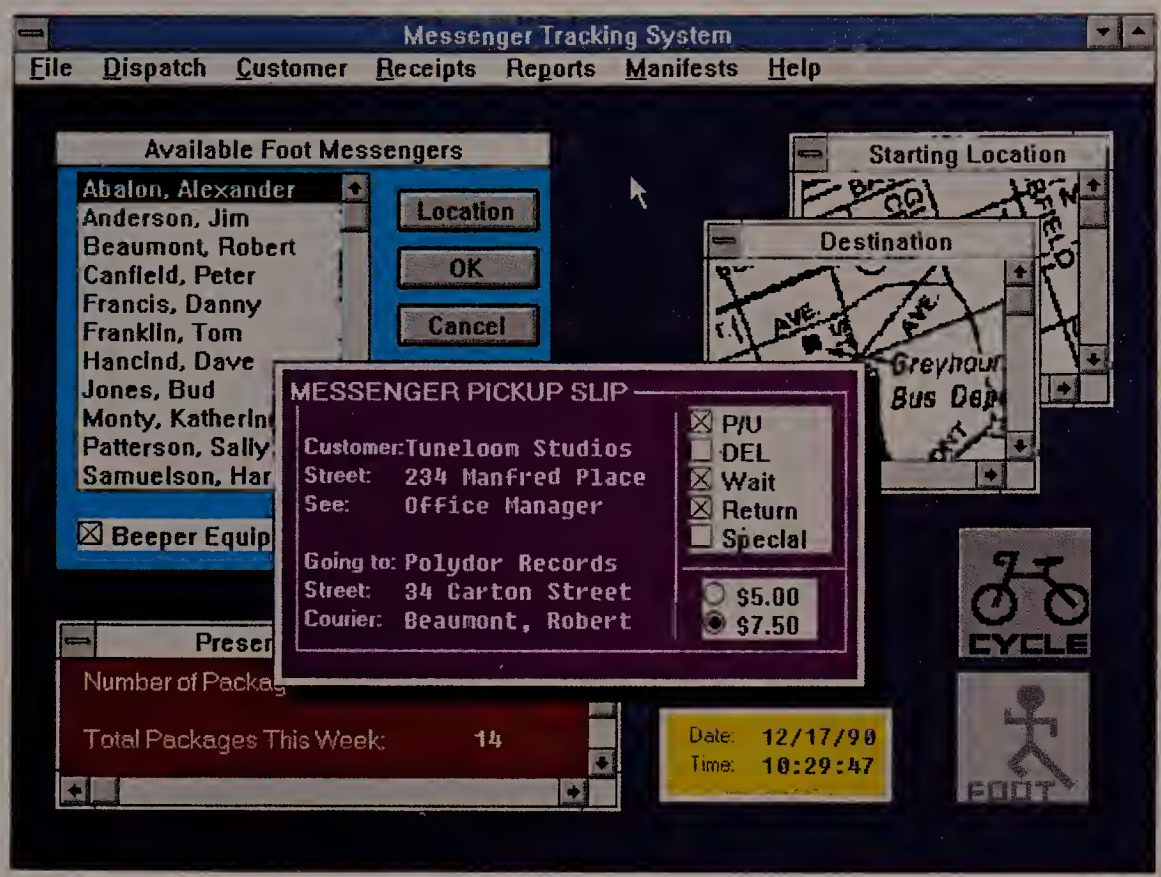

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Tape Backups You Set and Forget

You'd back up regularly—if you didn't have to think about it. Now you don't, thanks to automated backups and these 31 low-cost, DC2000 drives.

by Rex Farrance

Most of us know by now that backing up our hard disk is essential. Still, many of us aren't backing up regularly. Why? Because it's too hard to squeeze time from our busy schedules. According to market research experts from International Data Corporation (IDC), the size of hard disks on today's business PCs is growing and now averages about 100MB. So even with data compression, if you're backing up a full hard disk with high-density floppies, you're going to wind up shuffling 40 to 50 disks for each full backup.

No one wants to shuffle 50 floppies in and out of a drive. That's why we've packed this guide with 31 DC2000 tape drives that use data compression to store close to 200MB or more—plenty of room for nearly any desktop backup task. Best of all, most of these

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high-capacity units carry reasonable list prices between $300 and $600.

Are you still bored by the very idea of tape backups? According to Stan Corker, IDC tape wizard, you probably don't give backing up a second thought unless you've experienced painful data loss. The most common causes of data loss are user error, software error, and hard disk failure—in that order. Although disk trouble is the least likely of the three, it still accounts for 28 percent of all service calls.

Even the most dire of warnings won't make you back up if the job takes more time, effort, and dollars than you can spare. What you must have is an affordable and effortless backup system that manages to protect your data without cutting into your productivity.

Getting on the Backup Plan

Does this sound like pie in the sky? Not at all: Using a 250MB DC2000 tape backup drive and a good *Windows* backup package with tape support, you can schedule full automatic background backups once a week and several incremental modified-file backups a day without lifting a finger. The slowdown you may experience in *Windows* program performance during your backup is a small price to pay for this kind of convenience. You'll find minimal interference with the speed of applications running in a DOS window. And you can mitigate any effect on your work by scheduling full backups for when you're out to lunch or at the end of the day.

If you're not a *Windows* user, you can still back up your modified files in minutes at the end of the day with a good DOS package and run a weekly full backup when you're out of the office. These tape drives, with their capability to back up 200MB or more of data per cartridge, make it practical to automate even full backups. Then you'll probably have to rotate to a second tape only once every couple weeks even if you keep your hard disk jam-packed with programs and data. Considering tape backup's relative ease, there's no wonder Mr. Corker says that tape drive owners are generally the only users who implement a comprehensive backup strategy.

An effective game plan is the path to full protection. To maximize your safety while minimizing time and tape space, intersperse weekly full backups with more frequent incremental backups. All your full backups should include programs, data, and hidden files. You can enhance time and tape space savings with your incrementals, however, by backing up only important files. Schedule incrementals close enough together that when disaster strikes, you'll lose only a small amount of work.

The cost of a basic backup setup won't break you: A full tape system runs as little as $300 or less on the street, including tapes and software. Of course you can spend a lot

Software: The Key to Effortless Backups

The backup program that comes with your tape drive represents a big part of the drive's total value. It becomes your interface with the drive and should be a pivotal element in the buying decision. While the programs hold many similarities, ease of use varies. And not every drive comes with a *Windows* program. Some, such as the Irwin A250 models, tack on extra dollars for their *Windows* version. On the other hand, *Central Point Backup* for DOS and *Windows*—among the best backup programs around—are included in the basic price for drives from Iomega and Wangtek and two out of three Summit models.

A Smooth Path From Floppy to Tape

If you've been backing up with floppies, you may already have *Central Point Backup 7.1* for DOS or *Windows*, *Norton Backup 2.0* for DOS or *Windows*, or *Fastback Plus 3.1* for DOS. You can operate most QIC-80 drives with one of these programs, and *Central Point Backup 7.2 for Windows* supports many Irwin Accutrak models. Of course, you should check with your vendor to make sure your program works with the drive you're considering. If it does, you're in luck: *Central Point 7.1 for Windows* and *Norton Backup 2.0* for DOS won Best Buys in our July backup software review because of their accessible interfaces and terrific ease of use.

Down to Basics

Fortunately, all the bundled programs are roughly equal when it comes to bottom-line data security: You'll find error correction and an overwrite warning to prevent accidental loss of existing backup sets in every package. And all the programs except *CoreTape Light* and *Everex FTape* alert you if you are about to overwrite a newer file. In addition, every program includes data compression.

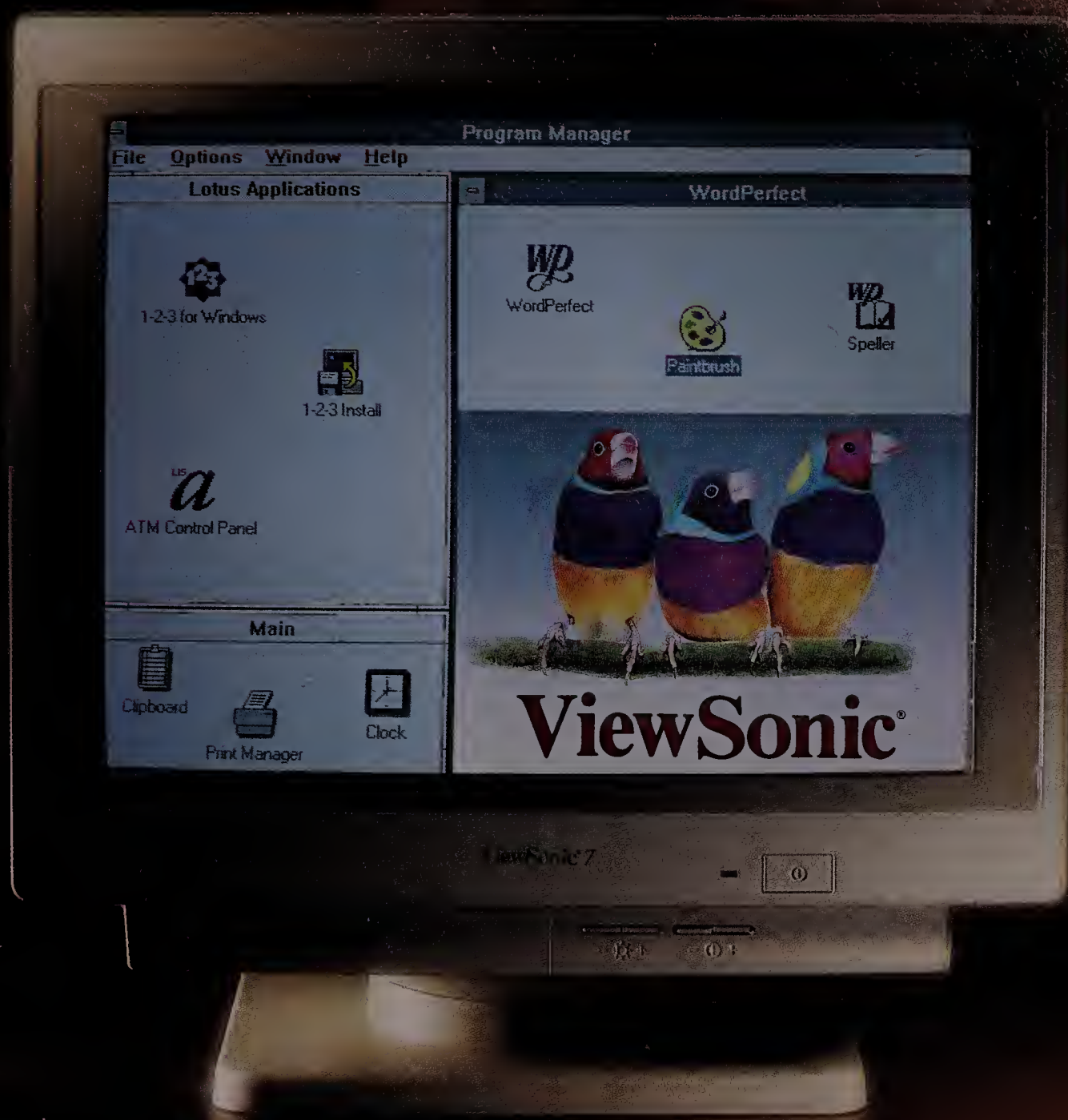
All the bundled backup packages give you basic automation features, letting you preschedule backups. But only the *Windows* and OS/2 programs add the sizable advantage of background backups. If you have multiple hard drives or partitions, look through the table to find a program that can back them up in a single session. Most programs let you select backups of multiple drives through a scheduler, even if they don't let you select an immediate multiple-drive backup. If you plan on backing up a lot of data, it's handy if the program predicts the time and space required to complete your backup: only *Everex FTape*, Maynard's *QICStream 3.0XL*, and Tallgrass's *FileSecure* lack this feature.

Elements of Choice

Every program lets you back up selected files or subdirectories as well as files modified since your last full backup. And all except *Colorado Backup for DOS* allow you to include or exclude hidden files in your backup, so if you have copy-protected programs that prohibit you from backing up, you can skip them automatically. With all the programs except Tallgrass's *FileSecure*, you can save tape space by excluding files by wild cards, such as *.BAK.

If you already own a good program that can run your new drive, you probably won't care what software comes with it. And you may prefer a vendor's hardware even if its software doesn't equal the top programs. Just keep in mind that buying another compatible backup program can add $80 or more to your overall cost. Every program except Tecmar's *MiniVault* gives you the basic option of password protection for your backups.

Big Screen for Windows



No question... this 17-inch monitor from ViewSonic is the ideal "big screen" choice for Windows. In fact, Byte, PC Magazine, InfoWorld, PC Computing and Windows Magazine have all given rave reviews to the ViewSonic 7. It's the price/performance leader, designed for people who know what they want and won't accept second best.

The competition claims we're unfair. That's because the ViewSonic 7, with resolution up to 1,280 x 1,024, features microprocessor-based memory along with 26 programmable preset modes. And it has a flat square, anti-static screen to eliminate distortion and provide a sharp, crisp to-the-edge picture. Plus, for a flicker-free image, it even boasts of ultra-high 76Hz refresh rate. For a safer environment, this monitor meets strict low-radiation Swedish MPR-II standards!

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Circle 218 on reader service card

High-Capacity DC2000 Tape Drives

● = Yes
○ = No
n/a = not applicable

Company	Product	List price	KEY FEATURES: Format	Type of unit	Warranty (months)	CAPACITY: Formatted capacity (MB)	Estimated maximum capacity with compression (MB)[1]	FORMATTING: Preformatted media available	Tape included	Tape preformatted
COLORADO MEMORY SYSTEMS	Jumbo 250	$349	QIC-80	internal	12	120	250	$32	○	○
	Jumbo 250 with KE-10	$509	QIC-80	external	12	120	250	$32	○	○
	Jumbo Trakker 250	$548	QIC-80	parallel	12	120	250	$32	○	○
CORE INT'L	CTL-AT	$350	QIC-80	internal	18	120	300	$240 for 5	●	●
	CTL-ATE	$610	QIC-80	external	18	120	300	$240 for 5	●	●
EVEREX SYSTEMS	Excel 120F	$359	QIC-80	internal	24	120	240	○	○	○
	Excel 120F	$409 [7]	QIC-80	external	24	120	240	○	○	○
IOMEGA	Tape250 Insider	$299	QIC-80 [9]	internal	24	120	250	$35	○	○
	Tape250 Insider Half-Height	$349 [11]	QIC-80 [9]	internal	24	120	250	$35	○	○
	Tape250 PC Powered	$499	QIC-80 [9]	external	24	120	250	$35	○	○
MAYNARD ELECTRONICS	Irwin Accutrak A250PC	$379	Irwin Servo	internal	24	120	250	$35	●	●
	Irwin Accutrak A250E	$599	Irwin Servo	external	24	120	250	$35	●	●
	Irwin EZPort A250EP	$548	Irwin Servo	parallel	12	120	250	$35	○	○
	Irwin Accutrak A850	$1095	Irwin Servo	internal	24	450	850	$40	●	●
	Irwin Accutrak A850E	$1395	Irwin Servo	external	24	450	850	$40	●	●
	Irwin QICTrak Q250PC	$379	QIC-80	internal	24	120	250	$45	●	●
	Irwin QICTrak Q250e	$599	QIC-80	external	24	120	250	$45	●	●
MICROSOLUTION COMPUTER PRODUCTS	Backpack QIC 80/250MB	$669	QIC-80	parallel	12	120	250	$33	○	○
MOUNTAIN NETWORK SOLUTIONS	FileSafe TD-250	$399	QIC-80	internal	12	120	250	○	○	○
	FileSafe 8000 Plus	$649	QIC-80 [22]	internal	24	120 [22]	250 [22]	○	●	○
	FileSafe 8000 Plus	$935	QIC-80 [22]	external	24	120 [22]	250 [22]	○	●	○
	FileSafe 8500 IDE	$599	QIC-80 [22]	internal	24	120 [22]	250 [22]	○	●	○
SUMMIT MEMORY SYSTEMS	Summit SE250	$375	QIC-80	internal	24	120	250	$150 for 5	○	○
	Summit XSE250	$475	QIC-80	external	24	120	250	$150 for 5	○	○
	Summit SE305	$449	QIC-80 [22]	internal	24	120 [22]	250 [22]	$150 for 5	○	○
TALLGRASS TECHNOLOGIES	FS250i	$519	QIC-80	internal	24	120	250	○	○	○
	FS250e	$795	QIC-80	external	24	120	250	○	○	○
TECMAR	MiniVault 250	$519	QIC-80	internal	24	120	250	$89 for 2	●	●
	MiniVault 250E	$639	QIC-80	external	24	120	250	$89 for 2	●	●
WANGTEK	3080PK	$440	QIC-80	internal	12	120	250	○	○	○
	E3080PK	$699	QIC-80	external	12	120	250	○	○	○

[1] Actual capacity with compression varies with compression scheme and file compressibility.
[2] Mean time between failures.
[3] 1-mbps high-speed controller with hardware compression.
[4] At 6 percent duty cycle.
[5] Included.
[6] Must use automatic scheduler to schedule backup of each drive.
[7] $469 with power supply; requires $60 adapter.
[8] External port version; designed for use with external drive only.
[9] Reads Irwin EZTape backups from Servo-format tapes.
[10] Both DOS and Windows versions included.
[11] Includes adapter for 5¼-inch bay.
[12] Model A250MC is a $549 Micro Channel–specific internal drive, which uses the floppy controller.
[13] At 5 percent duty cycle.
[14] DOS GUI and Windows versions included; OS/2 version $99.
[15] Requires separate connector.
[16] 1-mbps Micro Channel card.
[17] SCSI tape adapter not included with drive; drive also connects to Adaptec 1510, 1520, 1540, 1640, 1740 SCSI host adapters.
[18] Standard parallel connector provides 1-mbps rate with parallel ports.
[19] At 25 percent duty cycle.

more, depending on who is selling the drive and extras it may include. At the high end of the price spectrum, you'll find a SCSI model with greatly enhanced capacity and speed—you'll pay more than $1000 on the street for drive, adapter, and tapes.

Internal or External?

If you have a spare externally accessible drive bay, an internal tape drive is the most economical choice, saving you an average of more than $200 over a comparable external model. If you have only a 3½-inch storage bay free, you'll need to buy a drive that fits. And watch your drive heights; only 3 of the 16 internal units fit all 3½-inch bays.

If you lack a free bay or need to back up multiple PCs with a single tape drive, you'll need an external unit. External models need a port to hook up to, so you'll have to install an interface on each computer you want to back up—unless you pick up one of the new models that plug into your parallel port. These drives are comparable in price to other external drives, and if your PCs have the newer enhanced parallel ports, all of them can accomplish 1-megabit-per-second (Mbps) transfers, matching the rates of most high-speed controllers. Moreover, these printer-port models are your only

CONTROLLERS AND CONNECTIONS												
Works with floppy controller	Vendor sells standard floppy controller or adapter	1-mbps high-speed controller	Other high-speed controller	Micro Channel adapter	3½-inch drive	Fits 1-inch-height drive bays	MTBF [2] (thousands of powered-on hours)	Software provided	Multiple drives in same backup	Mouse support	Multiple user levels	Reader service number
●	○	$129	$229 [3]	$299	●	○	40 [4]	Colorado Backup for DOS	●	●	●	641
●	○	$129	$229 [3]	$299	n/a	n/a	40 [4]	Colorado Backup for DOS	●	●	●	641
n/a	n/a	n/a	n/a	$299	n/a	n/a	40 [4]	Colorado Backup for DOS	●	●	●	641
●	$89	○	○	$109	○	○	25	CoreTape Light	○ [6]	○	●	642
●	$89	○	○	$109	n/a	n/a	25	CoreTape Light	○ [6]	○	●	642
●	$60	$89	$129 [3]	○	○	○	10	Everex FTape	●	○	●	643
●	$60 [8]	$89	$129 [3]	○	n/a	n/a	10	Everex FTape	●	○	●	643
●	● [5]	$150	○	○	●	●	30	Central Point Backup [10]	●	●	●	644
●	● [5]	$150	○	○	● [11]	● [11]	30	Central Point Backup [10]	●	●	●	644
●	● [5]	$150	○	○	n/a	n/a	30	Central Point Backup [10]	●	●	●	644
●	$109	n/a	○	● [12]	●	○	50 [13]	EZTape [14]	○ [6]	●	●	645
● [15]	$109	n/a	○	$279 [16]	n/a	n/a	50 [13]	EZTape [14]	○ [6]	●	●	645
n/a	$109	n/a	n/a	n/a	n/a	n/a	50 [13]	EZTape DOS GUI	○ [6]	●	●	645
○	○	○	$349 [17]	$599 [17]	●	○	40 [13]	EZTape [14]	○ [6]	●	●	645
○	○	○	$349 [17]	$599 [17]	n/a	n/a	40 [13]	EZTape [14]	○ [6]	●	●	645
●	● [5]	$150	○	○	●	●	60 [13]	QICStream 3.0XL	●	●	○	645
● [15]	● [5]	$150	○	○	n/a	n/a	60 [13]	QICStream 3.0XL	●	●	○	645
n/a	n/a	● [18]	n/a	n/a	n/a	n/a	60 [13]	BPBackup	●	●	○	646
●	○	○	○	○	●	○	12 [19]	FileSafe [20]	○ [6]	○ [21]	○	647
●	○	$239	○	$239	●	○	12 [19]	FileSafe [20]	○ [6]	○ [21]	○	647
●	○	$239	○	$239	n/a	n/a	12 [19]	FileSafe [20]	○ [6]	○ [21]	○	647
○	○	n/a [23]	$79 [23]	○	●	○	30 [19]	FileSafe [20]	○ [6]	○ [21]	○	647
●	● [5]	$130	○	$250	●	○	30 [24]	Central Point Backup [10]	●	●	●	648
●	● [5]	$130	○	$250	n/a	n/a	30 [24]	Central Point Backup [10]	●	●	●	648
n/a	n/a	n/a [23]	$79 [23]	○	●	○	30 [24]	SummitSafe	○ [6]	●	○	648
●	○	○	○	○	●	○	40	FileSecure	●	○	○	649
●	○	○	○	○	n/a	n/a	40	FileSecure	●	○	○	649
●	○	$229	○	$249	●	○	40	MiniVault Software	○	○	○	650
● [25]	○	$229	○	$249	n/a	n/a	40	MiniVault Software	○	○	○	650
●	● [26]	$240	○	○	●	○	40 [27]	Central Point Backup [10]	●	●	●	651
●	● [26]	$240	○	○	n/a	n/a	40 [27]	Central Point Backup [10]	●	●	●	651

[20] $99 Windows package planned for December.
[21] Yes with optional Windows package.
[22] Has alternate format with 152MB native capacity and 305MB compressed capacity; these tapes are not QIC-80 compatible.
[23] IDE adapter; IDE controller supports 1-mbps transfers.
[24] At 15 percent duty cycle.
[25] Requires $60 kit.
[26] $11 connector/cable lets you add third floppy device.
[27] 10 percent duty cycle.

For more information about all products in this table, circle reader service no. 901.

choice for notebook tape backups. While we were preparing this guide, many vendors told us to expect new parallel products on the market soon after it appears.

Every tape drive here includes a minimum 12-month warranty, but you'll note a trend toward longer coverage: Over two-thirds of the models listed come with a two-year warranty. However, none of the three parallel models offers more than 12 months.

How Much Is Enough?

Without using compression, all the drives give you at least 120MB formatted capacity using an extended tape. Some models manufactured by Summit and sold by Mountain and Summit provide an alternative format that boosts native capacity to 152MB. If you wish to retain QIC compatibility with these drives, however, you can also use QIC-80 format. The more expensive Irwin Accutrak A850 models use a SCSI interface, a new head design, and media allowing much denser writes that boost formatted capacity to an impressive 450MB. Fortunately, these drives retain read-compatibility with other Irwin Servo-format drives, and the SCSI interface increases transfer speed to five times or more that of the fastest floppy models. In actual use, compressed capacity for all drives varies with file compressibility.

So while all vendors state their drives' compressed capacity as approximately twice the native capacity, or 250MB with a 120MB tape, that's a rough guideline, and our experience indicates that their 120MB tapes will hold closer to 200MB of typical business applications and data.

You have to format a DC2000 tape before it can store data. This process can be surprisingly time-consuming, taking 1½ to 3 or more hours in some cases, even if you can complete it in the same operation as the backup. The ability to format your tape while backing up is a convenience, although it slows down your first backup. If your vendor offers preformatted tapes, you can skip this onerous process entirely. Should you order tapes from a source other than your drive vendor, however, make sure you buy the specific preformatted tape that works with your drive. If your vendor includes a tape in the cost of the drive, you'll save $25 or more in street value.

Why We Chose 80MB/120MB DC2000 Drives

The QIC-80 or Irwin Servo-format 80MB/120MB DC2000 drives in this guide have the right capacity for today's backup needs, handling 200MB or more of compressed files on a single extended-length tape. Furthermore, these drives are compatible with many existing formats. QIC-80 drives can read tapes from popular 40MB/60MB QIC-40 drives. And Irwin 80MB/120MB Servo-format drives read Irwin 40MB tapes. Irwin 40MB/60MB formats are commonly found factory installed in many business PCs, including IBM and Compaq systems, and Irwin drives from Maynard are a likely choice if you already own Irwin Servo-format equipment. Even if you go for the more expensive Irwin Accutrak A850 SCSI models with their quick backup times and impressive 850MB maximum compressed capacity, you'll retain read compatibility with other Irwin Servo-format DC2000 tapes.

Three Ways to Go

The new Iomega DC2000 drives offer another option: These QIC-80 drives can read Irwin Servo-format tapes containing *EZTape* backups. Whether you choose a standard QIC-80 or Irwin Servo-format drive or one of the Iomegas—which let you straddle both worlds—you'll have a high-capacity, business-standard drive.

Controllers, Connections, and Longevity

Hooking internal drives to your system is a snap, because most DC2000 drives use your system's floppy controller. So unless your controller is already supporting its limit, you won't need to give up a slot or buy a controller for an internal model. If you do need an additional connector, however, it's convenient to be able to purchase an interface from your vendor.

While speed isn't a burning issue for many users, most manufacturers offer options that let you shorten your tape-backup times considerably. Several vendors offer optional 1-Mbps controller cards that effectively double your backup speed compared to floppy controllers. The Mountain FileSafe 8500 IDE and Summit SE305, on the other hand, hook up to the IDE interface on your motherboard, saving you a slot while also providing capability to back up at 1 Mbps. Backup speeds on PCs with slower processors decrease when you use software compression. Colorado Memory Systems and Everex offer optional compression controllers, which mitigate this effect while providing the same level of compression. If you have a PS/2 or other Micro Channel architecture PC, you'll need an MCA adapter for your machine.

You want your drive to last, so check the mean time between failures (MTBF) as a rough gauge of overall dependability. Remember that the MTBFs listed in the table are based on vendors' claims and have not been tested by *PC World*. Further, you should note that some vendors list duty cycles. A 5 percent duty cycle, for example, rates drive longevity with the drive in use 5 percent of the time it is powered on. Ultimately, the length of warranty is your best protection.

Set It and Forget It

Backup doesn't have to be tedious or expensive. When you consider what you have to lose in hours, days, or even months of work, you'll agree that going without a comprehensive backup strategy could be a tragic mistake. For economy and ease of implementation, you can't beat a personal backup system with a DC2000 tape drive. You can set it and forget it and rest easy, knowing you have your data insured.

Rex Farrance is an assistant editor for PC World. *He can be reached on PC World Online (see page 8 for more information).*

WHERE TO BUY

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510/498-1111 (fax)

Iomega Corp.
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801/778-3000

Maynard Electronics
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407/263-3555 (fax)

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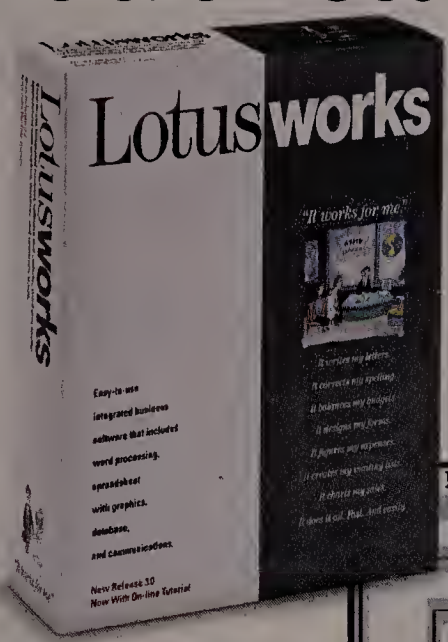

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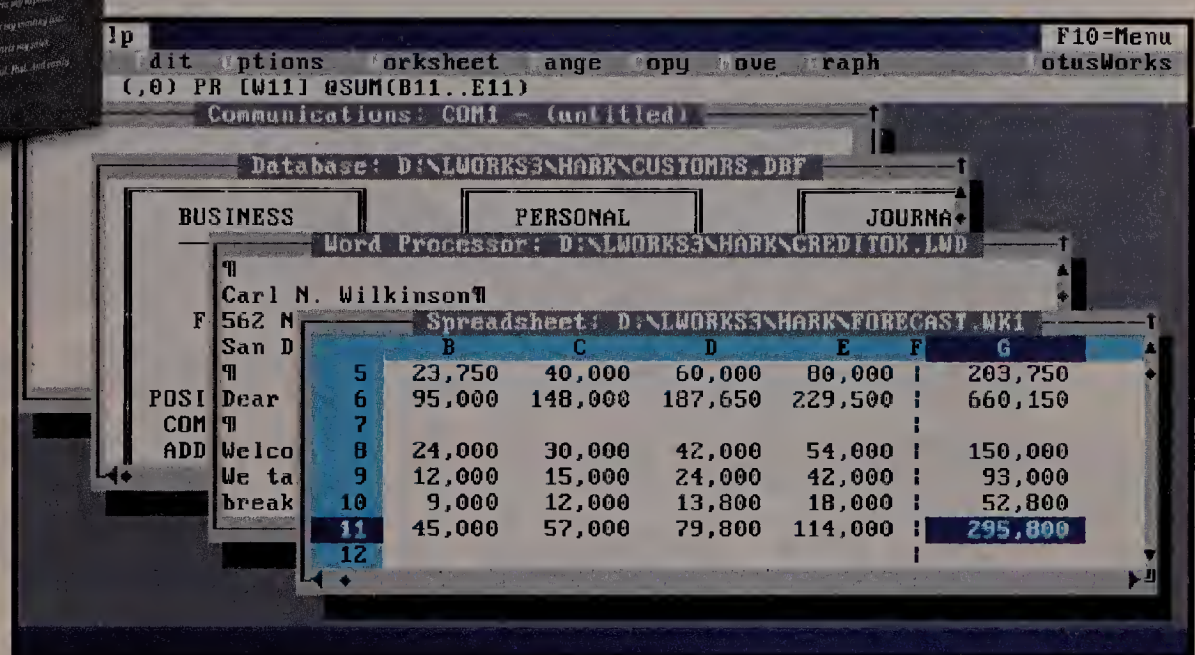

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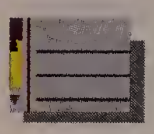

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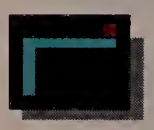

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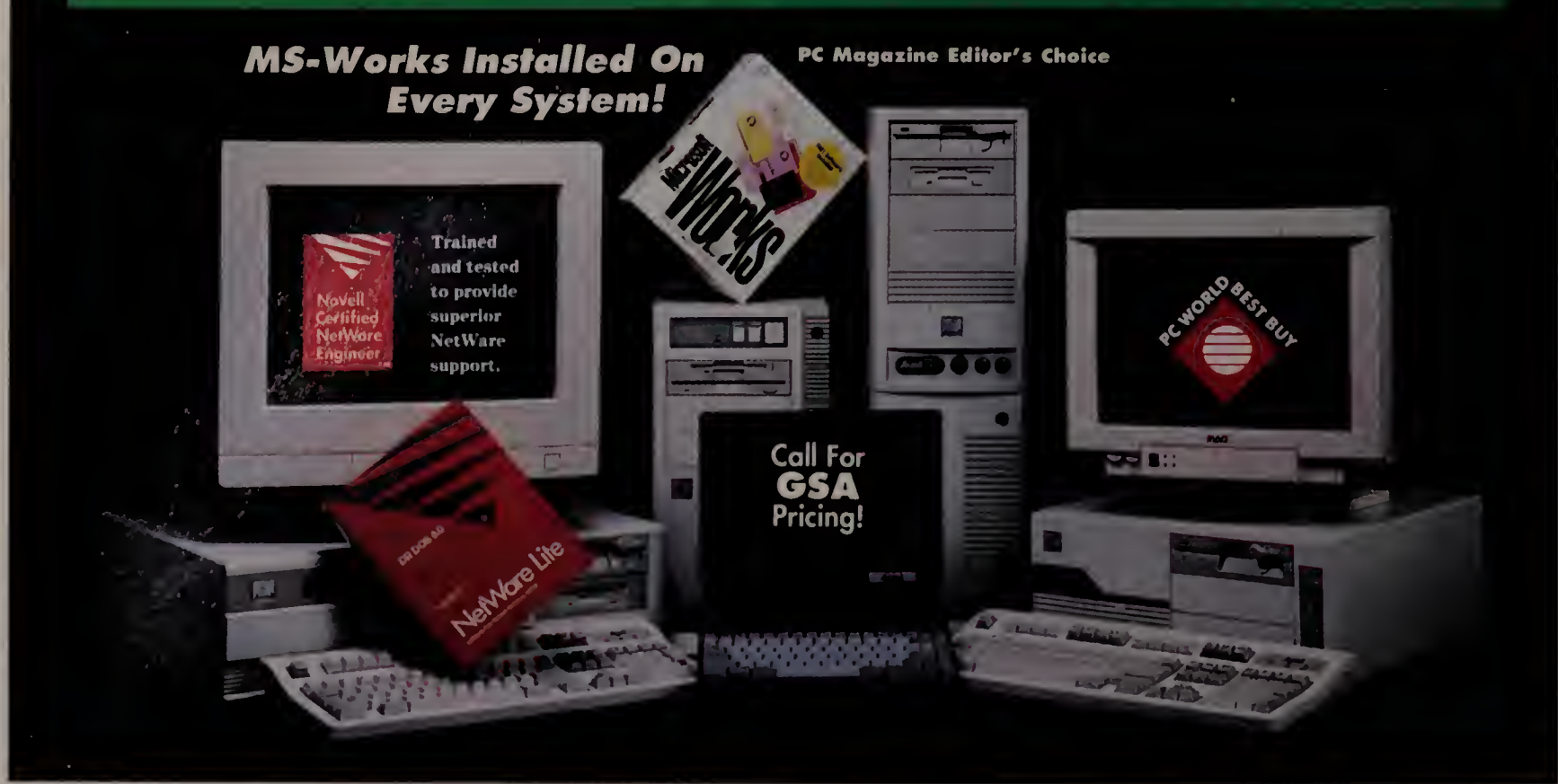

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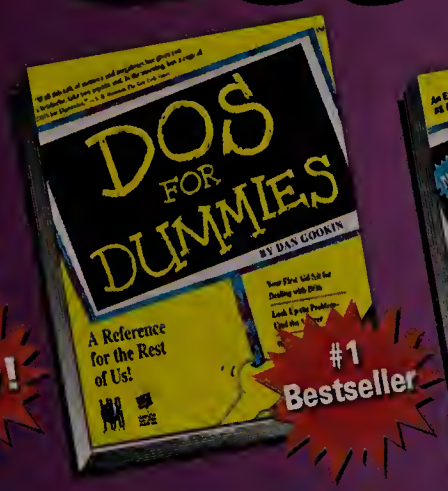

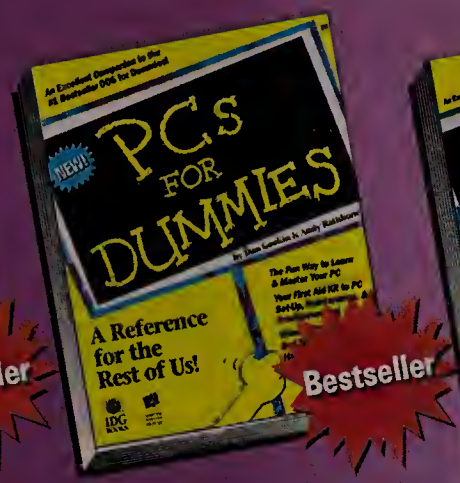

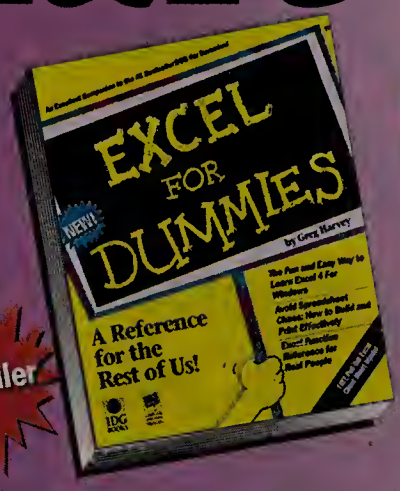

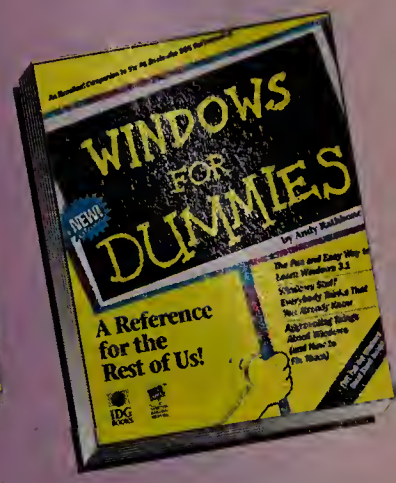

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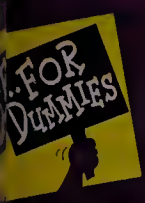

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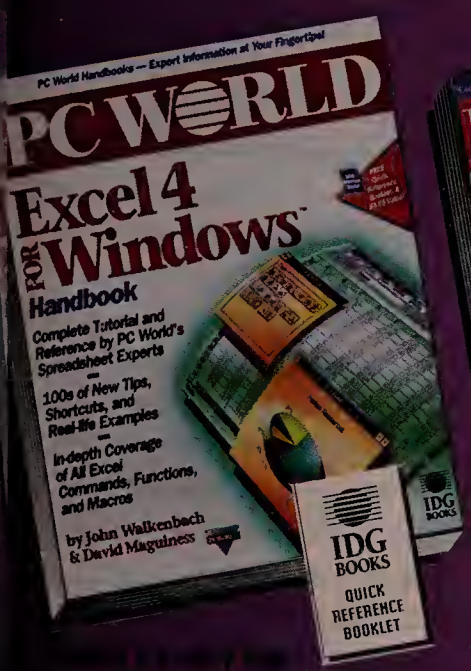

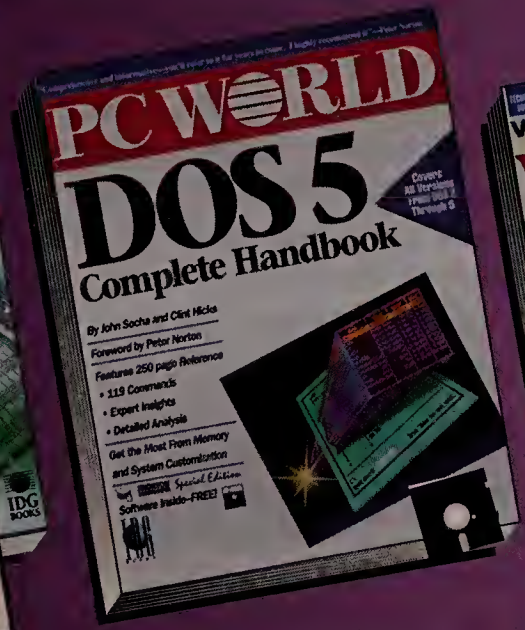

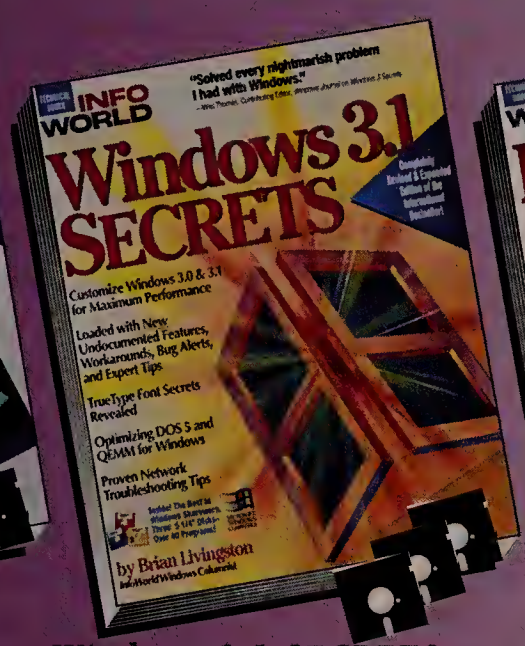

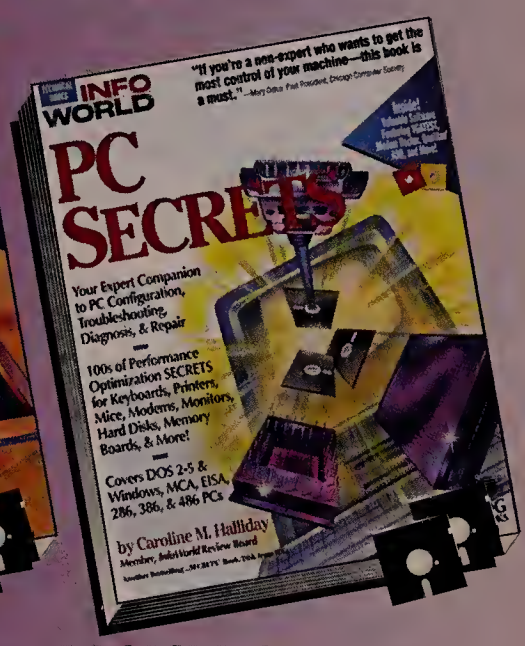

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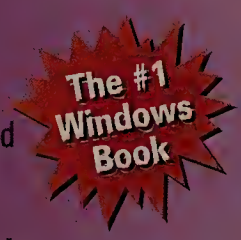

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Here's How

Spreadsheets 332 | Word Processing 343 | Windows 350 | Dialog Box 391

HELP LINE Q & A

Tip of the Month

SINGLE-STRIP PROGRAM MANAGER: Want one of those slick replacements for the *Windows* Program Manager—the kind that gives you a neat row of icons in a narrow strip—without paying for it? You've already got one; it's called Program Manager.

Using standard mouse movements, resize and reshape the Program Manager window into a strip, slightly higher than an icon, that stretches horizontally across the top or bottom of your screen. Next, double-click on the title bar of one of the group windows within Program Manager. This will make that group fill the narrow ProgMan window. Select *Window • Arrange Icons* to line up your icons neatly in the strip.

If the current group has more icons than can fit in a row, you can scroll through them a row at a time. Going to another group is as easy as selecting it from the Window menu. When you bring up a group for the first time, the icons will be randomly and inconveniently placed, but a quick *Window • Arrange Icons* will fix that. To save the configuration without exiting ProgMan, hold down the <Shift> key while you select *File • Exit.*

—Lincoln Spector
Associate Editor

Expanding on Disk Compression

Q I use *Stacker* to expand my hard drive from 20MB to 40MB. When I installed the program, it created a hidden file that takes up about 20MB. Is there any way to delete that file to recover additional disk space?
Jeff Kwon, Chula Vista, California

A No. That file is the key to the sleight of hand that makes your disk appear larger than it really is.

Stacker and other on-the-fly disk compression utilities work by storing almost all the files on a disk in a single compressed archive file. In a default *Stacker* installation, the only normal DOS files on the disk are the hidden system files IO.SYS and MSDOS.SYS as well as COMMAND.COM, CONFIG.SYS, any drivers loaded by CONFIG.SYS, and the hidden STACVOL.DSK file, *Stacker*'s compressed archive.

When DOS tries to read from or write to a file on the hard disk, a memory-resident utility (*Stacker*'s is called SSWAP.COM) intercepts the command and routes it to the compressed archive instead. When you enter a DIR command, SSWAP intercepts it, quickly browses the contents of the STACVOL archive, and feeds the appropriate information back into the DIR listing.

On-the-fly disk compression isn't as reliable as standard DOS file operations, so we suggest you use compressed volumes to store only programs and data that are backed up elsewhere. Since compression errors can trash a drive's File Allocation Table beyond recovery, the safest approach is to create two disk partitions. Allocate a few megabytes to a conventional, uncompressed C: drive, and use it to store any work you haven't yet backed up. Give *Stacker* the whole D: drive, and store your applications and backed-up files there.

Turning Extended Memory Into Expanded

Q Even though I have 4MB of RAM in my system, *1-2-3* release 2.3 still gives me 'memory full' messages. I hear I can use DOS 5.0 to change my system's extended memory to the expanded memory *1-2-3* can use. What entries do I put in CONFIG.SYS for the maximum amount of expanded memory?
George R. Pau, Carteret, New Jersey

A On a 286, you generally configure memory as XMS (extended memory) or EMS (expanded memory) by flipping switches on the motherboard or memory expansion board, or by using a special driver supplied by the vendor. Check your system's documentation or call your dealer for details.

On a 386 or 486, you can use DOS 5.0's EMM386.EXE utility to emulate EMS using XMS. To configure all your available high memory as EMS, add the following lines at the top of your CONFIG.SYS and reboot:

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE 9999
```

The number after 'EMM386.EXE' indicates the kilobytes of memory you want to allocate to EMS. The '9999' is just an arbitrary starting point for determining how much EMS you can allocate in your system. Since there's not actually 9999K of high memory available in your system, when EMM386.EXE loads, it will give you the error message 'Size of expanded memory pool adjusted'. To get rid of that message, make a note of the number of kilobytes of 'Available expanded mem-

ory' EMM386 displays on start-up and replace the '9999' in your CONFIG-.SYS with that number.

Consider upgrading to *1-2-3 3*.x. By accessing extended memory directly, it gains a significant speed boost over *2*.x versions.

PATH to the Environment

Q Is there a way to make a batch file change the PATH command's list of directories, run a series of commands, and then reset the original PATH?
Tariq Ali, Brooklyn

A In a batch file, you can save the current PATH for later restoration by assigning it to an environment variable. For example, to temporarily replace the PATH with C:\BACKUP, you'd start like this:

```
SET OLDPATH=%PATH%
PATH=C:\BACKUP
```

Unless your PATH command is close to its 127-byte limit, you can keep all your current PATH directories by *adding* C:\BACKUP to the PATH:

```
SET OLDPATH=%PATH%
PATH=C:\BACKUP;%PATH%
```

In either case, use the following commands to restore the original PATH:

```
PATH=%OLDPATH%
SET OLDPATH=
```

The last command is just good housekeeping—it frees environment space by clearing the OLDPATH variable. (Note that OLDPATH is an arbitrary choice, which you can replace with any name you please.)

If running your PATH-saving batch file generates an 'Out of environment space' error, add (or modify) the SHELL= line in CONFIG.SYS. Try **SHELL=C:\COMMAND.COM /E:512 /P** and reboot. If the error persists, increase the '512' to reserve more bytes for environment variables.

A Better DOS Than Windows

Q Does OS/2 2.0 obviate the need for a memory manager when running DOS applications?
Stephen C. Ertman, Tallahassee, Florida

A Pretty much. As with *Windows 3.1*, you can configure OS/2 2.0 to provide each DOS application with as much EMS and/or XMS memory as you wish. Both environments will also automatically provide DOS protected mode interface (DPMI) services to applications that use them to break DOS's 640K limit, such as *1-2-3 3*.x and *Paradox 3.5*.

Unlike *Windows*, OS/2 2.0 can actually provide more than 640K of free RAM for DOS applications under certain circumstances. Like *QEMM-386* and other third-party memory managers, OS/2 2.0 can, when running character-mode programs, remap the portion of the upper memory area normally reserved for VGA graphics, increasing the amount of available conventional memory by up to 96K.

Print Screen Graphics

Q Last year I replaced my IBM Proprinter with a Hewlett-Packard LaserJet IIP. The new printer is great, except it won't print graphics when I press the PC's <Print Screen> key. Am I missing something?
Dan Marvin, Olean, New York

A If you don't have DOS 5.0, yes. In earlier releases, DOS's memory-resident GRAPHICS command, which provided the graphics routines necessary for you to use the <Print Screen> key in CGA, EGA, and VGA graphics modes, supported only IBM printers. In DOS 5.0, the command works with several HP printers as well.

By default, GRAPHICS formats its output for the IBM Proprinter, so before printing graphics screens to your LaserJet, enter the command **GRAPHICS LASERJETII**. If you use <Print Screen> often, put that command in your AUTOEXEC.BAT. With earlier LaserJets or compatibles, you might need to replace 'LASERJETII' with **HPDEFAULT** or **LASERJET**. Other HP printers supported by DOS 5.0's GRAPHICS include the DeskJet, PaintJet, QuietJet, RuggedWriter, and ThinkJet.

USER GROUP OF THE MONTH

Las Vegas PC Users Group

The December User Group of the Month is the Las Vegas PC Users Group, which publishes a monthly newsletter that lists volunteers offering support. LVPCUG also has special interest groups for beginners and for users interested in accounting, *dBASE*, database design, desktop publishing, genealogy, investments, *ObjectVision*, OS/2, *Windows*, *WordPerfect*, and *Quattro Pro*. Members have free access to over 1000 shareware and public domain programs.

For more information, contact Trent Eyler, president, 316 Bridger Ave. #240, Las Vegas, NV 89101; 702/431-4333. The $25 annual fee entitles your entire family to membership.

Multiple Drives, More Partitions I recently added a second hard drive to my system and produced a minor disaster: With my original drive partitioned into four logical drives and my new drive partitioned into three, DOS renamed my original partitions. The old drive's first partition is still C:, but the new drive's first partition became D:, while the old drive's second partition—the original D:—is now E:, and so on. All the path references in my system, except those to drive C:, are suddenly incorrect!

If this happens to you, here's an easy solution: Before you put anything on your new drive, XCOPY your files from the old partitions to the new ones with their names. For instance, to move files from the old D: to the new D:, use XCOPY E:*.* D: /S /E /V. Once you're satisfied the files have been properly copied, format E: to gain the disk space you've just paid for.

–Trent Eyler
Las Vegas PC Users Group

Swapping Drive A: for B:

Q I made a bootable 3½-inch "disaster disk" of disk recovery utilities when I got my PC. I now realize my PC boots from a floppy only in its 5¼-inch A: drive, not the 3½-inch B: drive. Must I create a 5¼-inch version, or could I boot my PC from drive B: in an emergency?
Mary Bonnell, West Brooklyn, Illinois

A If you have a bootable 5¼-inch disk, you can run your recovery utilities from the disaster disk in your B: drive.

On most computers, switching the primary (A:) and secondary (B:) drives involves opening up the case, swapping the two connectors that hook the drives to the shared data cable, and possibly changing jumpers on the drives. When the drives are different types, as in your system, you'll need to run the computer's setup program to change your computer's CMOS settings. In a few systems, a special CMOS option lets you swap A: and B: without having to open the case. However, not all such systems will boot from the new A: drive.

Long Parallel Cables

Q I've heard of "parallel extenders" that let you hook up a parallel printer at a longer distance than normal. Do they work with laser printers, what do they cost, and where can I get one?
Martha Phillips, via Internet

A We tracked down two such products. Both use standard twisted-pair telephone cable and RJ-11 jacks. Intellicom's Long-Link III can span 1200 feet; its Long-Link II can go 7000 feet; and Protec Microsystems' XtendPlus can stretch 8000 feet. Most parallel port printer-sharing devices can also reach well past the maximum 25-foot range of standard parallel cables (for a list of such devices, see "Share Peripherals Without Networking," September 1991).

• **Long-Link III Series** $149 to $189; Intellicom, Inc.; 800/992-2882, 818/407-3900, 818/882-2404 (fax)
Reader service no. 681

• **XtendPlus Parallel Port Extender** $310; Protec Microsystems, Inc.; 800/363-8156, 514/630-5832
Reader service no. 682

Hidden _iles

Q I've upgraded to DOS 5.0. Now I find that for every executable file in every directory of my C: drive, there's a 77-byte hidden file with the same name except that the first letter of the extension is replaced with an underscore, as in CHKDSK._XE. What are these files and how do I get rid of them?
Robert A. Waugh
Durham, North Carolina

A They have nothing to do with DOS 5.0—those files were created by *Norton AntiVirus 1.5* and earlier releases. The program performs a calculation on the bytes in the program file and stores the result—the "checksum"—in the hidden files. If the program is infected by an unknown virus, its checksum won't match the one stored in the hidden file, and *NAV* warns you of the infection.

Newer releases of *NAV* use a single checksum file, and installing an upgrade will strip the _XE and _OM phantoms from your drive. If you want to get rid of those files without upgrading, switch to the directory where *NAV* is installed and enter **UNINOC C:**.

Automated TSR Programming

Q I've looked everywhere and can't find instructions on how to program terminate-and-stay-resident utilities. Can you recommend any references, or are TSR programming techniques reserved only for computer gurus?
Bruno Tramontozzi
Newton, Massachusetts

A Much information crucial to programming TSRs (also called memory-resident programs) is undocumented, and even when you dig up the information, writing a good TSR is still a major challenge. A better solution than reinventing the wheel is to buy an off-the-shelf TSR kit that handles the trickier aspects. *PC World*'s programming expert, *Dialog Box* editor Brett Glass, recommends the *Magic TSR Toolkit* for Turbo Pascal, *TeSseRact* for assembly language, and *TSRs Made Easy* for both C and assembly.

• **Magic TSR Toolkit** $200; Quantasm Corp.; 800/765-8086, 408/244-7268 (fax)
Reader service no. 683

• **TeSseRact RAM Resident Development System** $89; Innovative Data Concepts; 800/926-4551, 215/443-9705
Reader service no. 684

• **TSRs Made Easy** $49; TurboPower Software; 800/333-4160, 719/260-9136
Reader service no. 685

```
A 100
MOV AX,40
MOV DS,AX
AND BYTE PTR [17],DF
INT 20

R CX
C
N NLOCKOFF.COM
W
Q
```

FIGURE 1: Use this text file of DEBUG keystrokes to create NLOCKOFF.COM, a program to turn off Num Lock.

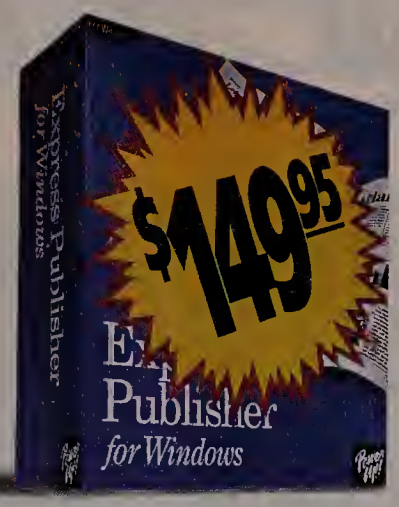
Num Lock–Off Correction

The figure of DEBUG keystrokes accompanying September's item on NLOCKOFF.COM, a utility you can put into AUTOEXEC.BAT to turn off Num Lock automatically when you start your PC, was printed incorrectly—the blank line that should have followed the INT 20 command was missing. The corrected figure is shown in **FIGURE 1**. Using any text editor, type the lines as shown, pressing **<Enter>** at the end of each line and to create the blank line. Save the file as **NLOCKOFF.SCR**. Enter **DEBUG < NLOCKOFF.SCR** at the DOS prompt to create NLOCKOFF.COM.

By Robert Lauriston

Mail your questions to Help Line, PC World, *501 Second St. #600, San Francisco, CA 94107; or send them electronically to PC World Online, Help Line; CompuServe, 75300,3205; MCI Mail, 381-7106; Internet, rlauriston@aol.com; or 415/442-1891 (fax).* PC World *pays $50 for published questions. Sorry, we cannot acknowledge unpublished materials.*

Robert Lauriston is a contributing editor for PC World.



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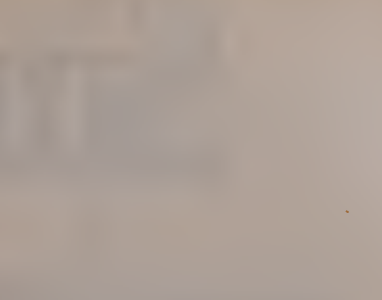

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SPREADSHEETS Q & A

Negative 1-2-3

Q Is there some way to get *1-2-3* to display and print negative percentages in parentheses? If I use the regular percent format on a formula that returns –04, I get –4%. What I want is (4%).

Michael Lewandowski
Oklahoma City, Oklahoma

A There's no way to do this with the */Range•Format* command or, for that matter, to do it gracefully at all. The best solution is a somewhat unsightly formula like the one below, the result of which is a string of marginal usefulness.

To display a number as a percentage—and in parentheses if it's a negative number—use **@IF(***ValueAddress***<0, "("&@STRING(@ABS(***ValueAddress***)*100, 0)&"%)",@STRING(***ValueAddress****100, 0)&"%")**, where *ValueAddress* is the cell address or range name with the number you need formatted. When the number is negative, the '*100,0' multiplies its absolute (positive) value by 100 and rounds that value to zero decimal places, and the @STRING() function converts the result to a string; the ampersands paste the parentheses and percent sign to the label. When *ValueAddress* is positive, the second @STRING() function adds a percent sign but no parentheses.

The problem, of course, is that you end up with labels rather than numbers—you can't do anything with the results except look at them and print them. Your best bet, therefore, is to keep one range with the actual numbers, and another with the formula discussed here, for display purposes only. If you like, you can hide the number column with the *Worksheet•Column•Hide* command.

Stepping Back a Month—in Any Spreadsheet

Q I use *Excel 4.0* for accounting, and I need a formula to calculate the last day of the previous month. I've tried lookup tables, but there must be a neater way to do this.

Ken Trumble,
Dover, Delaware

A Yes, there is—more than one, in fact. Since you're using *Excel 4.0*, check out the EOMONTH() function supplied with the new Analysis Toolpack add-in. EOMONTH() stands for *End of Month*, and it's intended for exactly what you need. You pass it a date and the number of months *Excel* should count, backward or forward, to get to the month you need an end date for.

For the last day of the previous month, use the formula **=EOMONTH(***Date Address***,-1)**, where *Date Address* is the cell address or the range name for the date you need processed. =EOMONTH(*DateAddress*,0) yields the last day of the current month, and so forth.

Excel users who haven't upgraded to *4.0* can use a slightly more complex formula: **=DATE(YEAR(***DateAddress***), MONTH (***DateAddress***), 0)**. The DATE() function's normal syntax is DATE(*year, month,day*), and specifying the day as zero causes *Excel*'s DATE() function to roll back to the previous day.

Although the *1-2-3* and *Quattro Pro* @DATE() function has the same syntax, a zero doesn't roll back the month as it does in *Excel*. The solution—and this formula works in every spreadsheet that I know of—is **@DATE(@YEAR(***Date Address***), @MONTH(***DateAddress***),1)-1**. The @DATE() function, with the help of @YEAR() and @MONTH(), returns the first day of *DateAddress*'s month; subtract 1, and you get the last day of the previous month.

1-2-3 Consistency Checking

Q I have a set of experimental values in a *1-2-3* spreadsheet that were generated by a laboratory data collection device, and I sometimes need to make sure that all the values in column A are identical. What's a quick way to check this?

Bill Feenman
Greensboro, North Carolina

A If the values you want to check are in the range A2..A1000, the formula **@ABS(@MIN(A2..A1000)-@MAX(A2..A1000))=0** will give you the results you need. When this formula returns a 1 (true), the values in the range are all the same; when it returns a 0 (false), it means there is a discrepancy.

If you decide that the values don't need to be absolutely identical, you can quickly modify the formula so it will check for variation within a given range. For example, **@ABS(@MIN(A2..A1000)–@max(A2..A1000))<.001** is true when the values vary by less than .001.

Spreadsheet Toolbox

Make No Mistake

You're in the audience as your boss presents your big project to the division heads. It's a giddy feeling when she puts your worksheets up on the big screen and makes the case for the deal. Suddenly a hand goes up, and a bass voice from the back of the room asks, "How do you expect us to trust your plans when you've misspelled 'potato'?"

Cripes! If only you'd known about *Spellin*, a $95 add-in for *1-2-3* release 2.*x* and 3.*x*. It lets you check the spelling in a range or in an entire worksheet and provides the equivalent to most word processing spelling checkers: When it detects a suspect word, *Spellin* presents a menu of possible replacements. You can add names, technical terms, and other unusual words to one or multiple custom dictionaries. *Spellin* detects repeated words and capitalization errors, and it provides a search-and-replace feature for users of releases prior to *2.2*.

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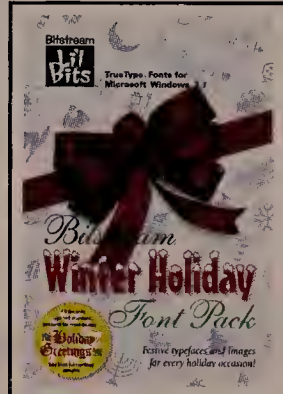

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Hiding Quickly in Excel

Q I often hide columns in *Excel 4.0*, but I find Format•Column Width•Hide a little awkward to use. Isn't there some quick way to hide and unhide a column using the mouse?
Doris F. Isles, Durham, North Carolina

A To hide a column, put the mouse pointer on the line at the right edge of the column heading in the worksheet frame. The pointer changes shape, as shown at the left in **FIGURE 1**. Drag it to the left in order to shrink the column to zero width.

To unhide the column, put the mouse pointer just to the right of the hidden column in the frame—it changes to the shape shown at the right in **FIGURE 1**. Drag right, and you adjust the width of the hidden column; double-click, and *Excel* automatically widens the hidden columns to accommodate their contents.

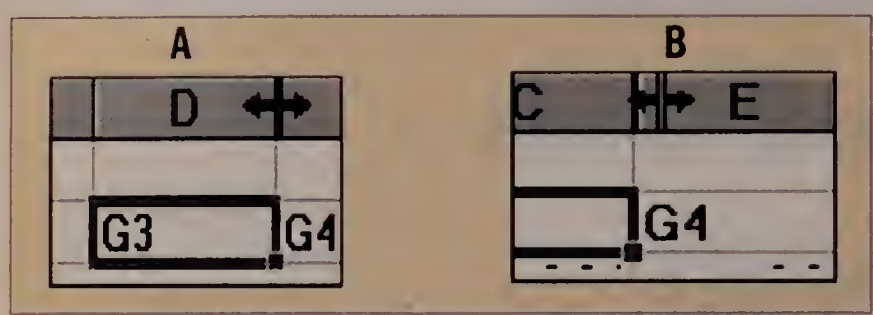

FIGURE 1: Look for the A mouse cursor when hiding a column and the B one when unhiding it.

Excel Extraction

Q As a new *Excel* convert, I'm a little frustrated with the program's procedures for extracting records from a database. I keep a personnel database, including the number of days each employee has been absent from work. It's easy to extract a list of people who have been absent five days: I just put a '5' under ABSENT in the criteria range. And when I want a list of everyone who was absent for less than ten days, *Excel* lets me put '<10' in the column. But how can I get a list of people who were absent between five and ten days?
Valdosta Broomfield
Greenville, Tennessee

A Check the criteria range C10:D11 in **FIGURE 2**; it has two field headings for ABSENT (C10 and D10). The entry in C11 selects people absent five days or more; the one in D11 selects those absent less than ten days. Since both restrictions appear on the same row, records must meet both of them to be selected. The results of the process are shown in rows 14 and 15. If you subscribe to PC World Online, you will find the worksheet, under the name ABSENT-.XLS, in the archive file DEC_SPRD.ZIP. (Note: This trick will not work in *1-2-3* and *Quattro Pro*).

	A	B	C	D
1	NAME	DEPT	SALARY	ABSENT
2	Crosby, David	Mkt	25,000	2
3	Danko, Rick	MIS	41,000	4
4	Dylan, Bob	MIS	33,000	5
5	McGuinn, Roger	Sales	56,000	0
6	Nash, Graham	MIS	18,500	12
7	Stills, Stephen	Train	78,000	11
8	Young, Neil	Train	122,000	8
9				
10			ABSENT	ABSENT
11			>=5	<10
12				
13	NAME	DEPT	SALARY	ABSENT
14	Dylan, Bob	MIS	33,000	5
15	Young, Neil	Train	122,000	8
16				

FIGURE 2: This Excel worksheet shows how to extract data that falls between two numbers, by including two criteria for the same column.

	A	B
1	\0	{/ View;NewWindow}
2		
3	\C	{/ ValueColors;Min}10~
4		{/ ValueColors;Max}100~
5		{/ Valuecolors;Enable}~

FIGURE 3: This Quattro Pro macro library file lets you easily regain your conditional colors by typing <Alt>-C.

Excel 4.0's Shrinking Titles

Q I have a large worksheet that I want to print at 90 percent size using *Excel 4.0*'s File•Page Setup•Reduce/Enlarge To feature. I specify columns A through D and row 1 as print titles. But the printout comes out all wrong: columns A:M (not A:D) are repeated on every page, and there are stray vertical lines on each page. When I set the scaling back to 100 percent, everything prints fine. What am I doing wrong?
Chi-Li Tang, Whittier, California

A You're not doing anything wrong—*Excel* is. This is a known bug; Microsoft is aware of it. There is no known work-around, so you should simply avoid reducing reports that contain titles. Microsoft has promised to fix the problem in a future release.

Consistent Quattro Color

Q I recently upgraded to *Quattro Pro 4.0* and was delighted with the conditional colors feature (/Options•Colors•Conditional), which lets me specify one text color for values less than a given level, another for values above another level, and a third for values in between. The problem is that once I've set up the conditional numbers, I can't get *Quattro* to remember them from one work session to the next. I've tried the Options•Update command, to no effect. How can I keep the numbers for my conditional colors?
William E. Prendergast
Edison, New Jersey

A Here's a work-around: In a blank worksheet, create the macros shown in **FIGURE 3**. Remember to type in apostrophes (') before the backslashes (\) in cells A1 and A3. Then select *Edit•Name•Labels•Right*, highlight cells A1..A3, and press **<Enter>**. Next select *Tools•Macro•Library•Yes*.

Select *File•Save As* to save the worksheet as QUATTRO.WQ1. To go back to your preferred settings, retrieve your worksheet and press **<Alt>-C**.

Here's how it works: When you load *Quattro*, the program looks for a file named QUATTRO.WQ1 and loads it if found. If QUATTRO.WQ1 has a

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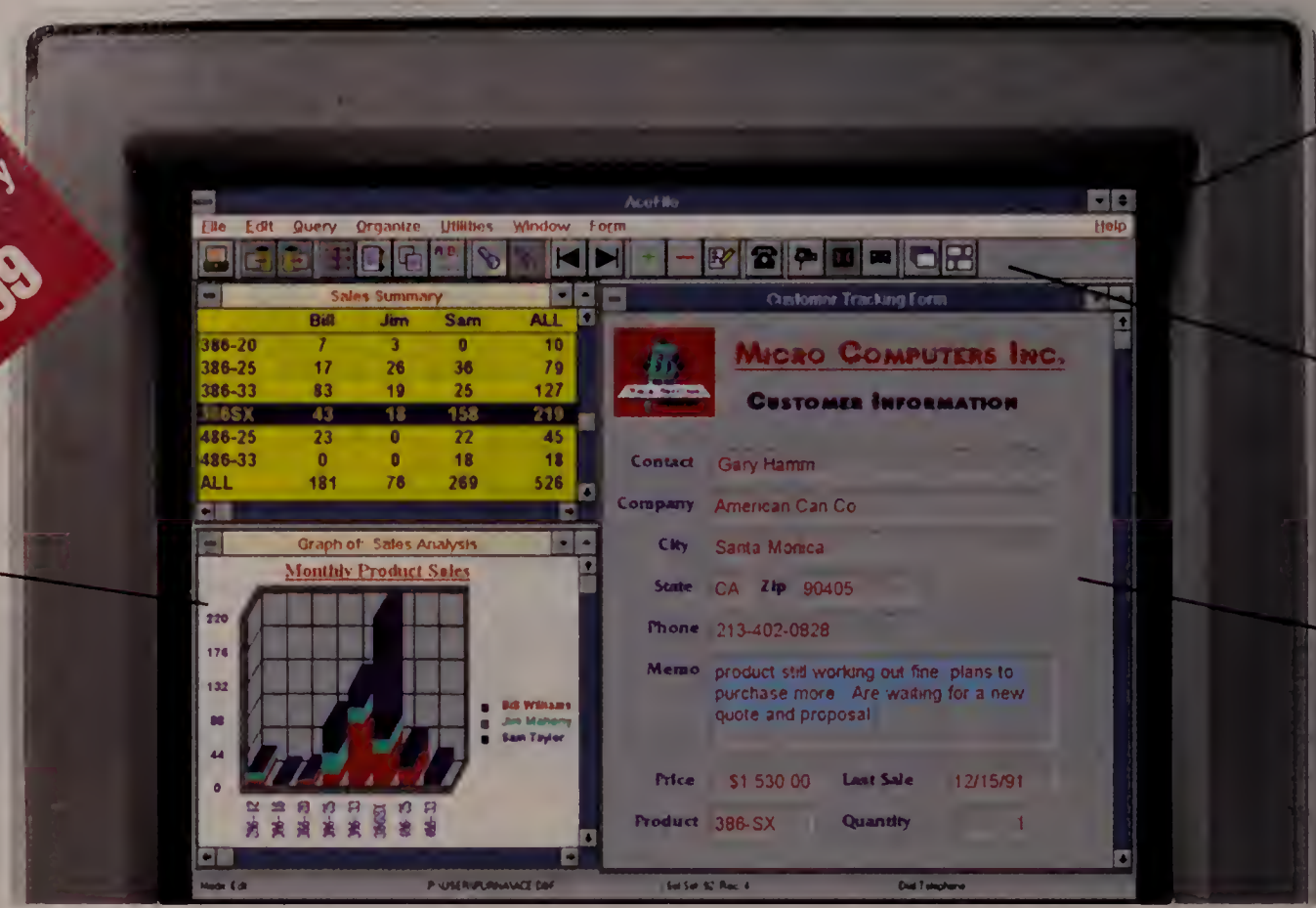

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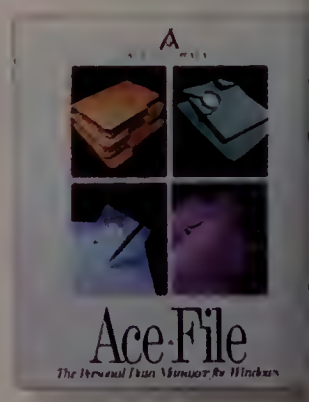

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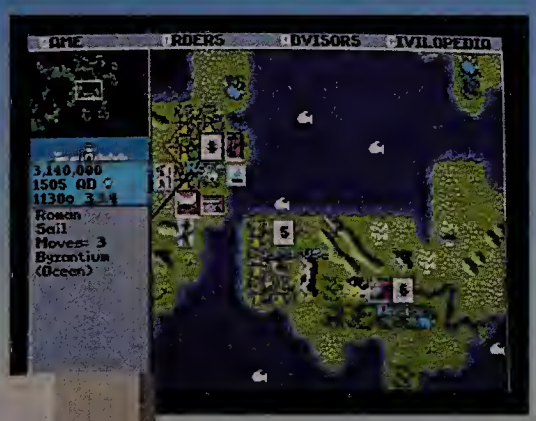

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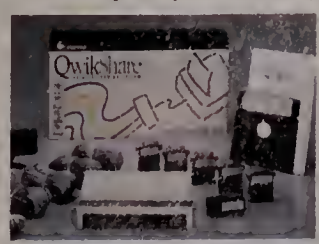

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macro named \0, *Quattro* executes it automatically. In this case, the macro simply opens a blank worksheet to make the screen appear as it does when you load the spreadsheet.

The three statements in the \C macro execute the conditional color commands: B3 sets the minimum normal value to 10, B4 sets the maximum normal value to 100, and B5 enables the conditional colors (you'll probably want to change the numbers in the first two commands). Because you've designed QUATTRO.WQ1 as a macro library, you can execute its macros in any

Master Class: Excel Crosstabs

Lots of folks use their spreadsheet as a database manager because it's so handy: No need to learn a new program; just fire up *1-2-3* and enter the data. It's when you want to summarize the records in some kind of understandable fashion that the going starts to get tough. But if you're using *Excel 4.0*, the Crosstab Wizard will help you create database summary reports easily. Here's how to do that.

CLINIC.XLS

	A	B	C	D	E
1	Patient ID	Date	Test Score	Dosage	Team
2	E1726	10/10/91	15 3	3	YELLOW
3	H1913	10/10/91	12 5	2 5	BLACK
4	Y3200	10/11/91	16 3	6 5	BLACK
5	X1520	10/13/91	17 1	7 5	WHITE
6	K9263	10/14/91	15 2	6	YELLOW
7	J6652	10/16/91	12 6	5	YELLOW
8	J5313	10/17/91	15 5	5	WHITE
9	V6758	10/17/91	15 2	5 5	GREEN
10	W1502	10/18/91	17 7	7	YELLOW

RESULTS.XLS

	A	B	C	D	E	F	G	H
1	Average Dosage	Test Score						
2	Team	12 to 14	14 to 16	16 thru 17	12 to 14 Ct	14 to 16 Ct	16 thru 17	Grand total
3	BLACK	2 5	#N/A	6 5	1	0	1	4 5
4	GREEN	#N/A	5 5	#N/A	0	1	0	5 5
5	WHITE	#N/A	5	7 5	0	1	1	6 25
6	YELLOW	5	4 5	7	1	2	1	5 25
7	Grand total	3 75	4 875	7	2	4	3	5 333333

A crosstab report (RESULTS.XLS) can easily summarize data from an Excel database such as CLINIC.XLS.

Let's assume you're using *Excel* to keep a quality assurance database for a health clinic. The challenge is to compare the dosages of medication prescribed to outpatients by your clinic's patient-care teams (code named *YELLOW, BLACK*, and so on), with the patients divided into those with low (12 to 14), medium (14 to 16), and high (16 to 18) test scores.

To prepare, recreate the CLINIC worksheet shown here (if you subscribe to PC World Online, you will find CLINIC.XLS in the archive file DEC_SPRD.ZIP), select A1:E10, and execute the command *Data • Set Database*. To start the Wizard, select *Data • Crosstabs*.

An *Excel* Wizard is a sequence of dialog boxes that walks you through what might otherwise be a complex and confusing procedure. In the first box, click *Create a New Crosstab*. In the next dialog box—Row Categories—you must select a field to break the data down by; select *Team*, click *Add*, then click *Next* to proceed.

Since you want to break down the information by test scores, select *Test • Score* and click *Add* in the next box—Column Categories. To delimit the test score levels, click *Options;* at the resulting Options box, enter the following values: In Groups of 2; Starting at 12; Ending at 17.99.

In the Insert Subtotals box, click on *Count*, so the Crosstab table will show the number of patients in each test score group. Finally, click *OK* to return to the Column Categories box, then *Next* to move on.

In the next box—Value Fields—select *Dosage*, click *Add*, then *Options*. For your Calculation Method, select *Average*. Click *OK*, and then *Next* to proceed to the Final dialog box.

Click on *Set Table Creation Options*, and in the dialog box, select *No* for the 'Create an outline' and 'Define names' options, and click *OK*. Finally, click *Create It*.

When the smoke clears, you'll find that *Excel* has created a new worksheet with your report—the RESULTS sheet shown. Columns B:D show the average dosage for the three test groups, with #N/A's if a group has no score to average. Columns E:G show the number of patients in each group seen by each team. Finally, column H shows the average dosage prescribed by each team. If 'Grand total' numbers look odd, it's because *Excel* doesn't round them out.

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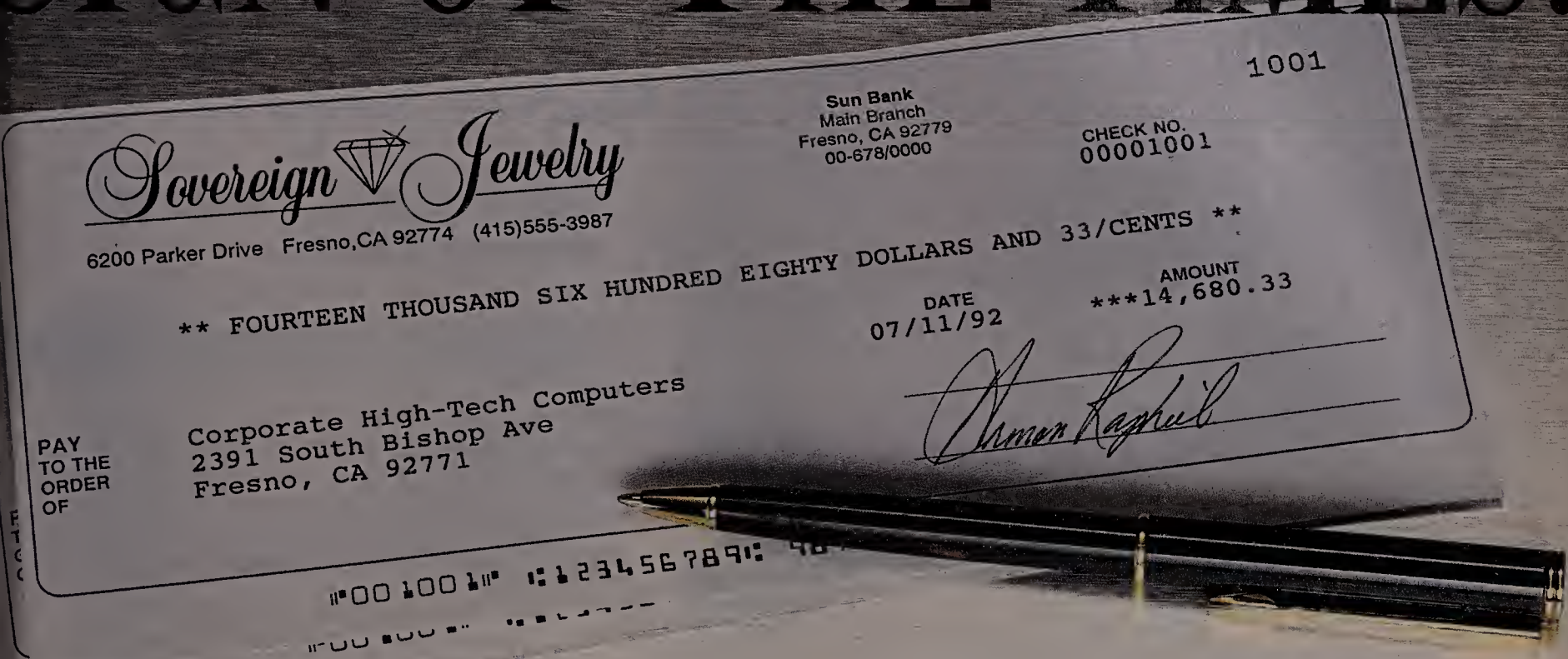

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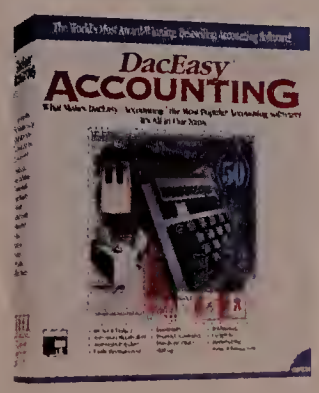

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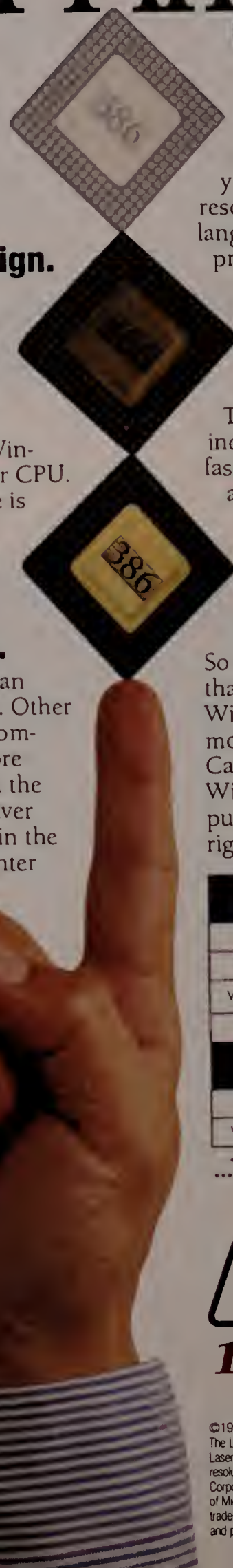

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open worksheet. When you open one of your worksheets, you can reestablish the conditional colors with a single keystroke.

By Richard Scoville

Mail your spreadsheet questions to Spreadsheets, PC World, *501 Second St. #600, San Francisco, CA 94107; or send them electronically to PC World Online, Spreadsheets; CompuServe, 72341,2727; MCI Mail, 357-4517; or 415/442-1891 (fax).* PC World *pays $50 for published questions. Sorry, we cannot acknowledge unpublished materials.*

Richard Scoville is a contributing editor for PC World *and a software training consultant based in Chapel Hill, North Carolina.*

POWER TIP no. 268

Adding ZMODEM to Procomm Plus

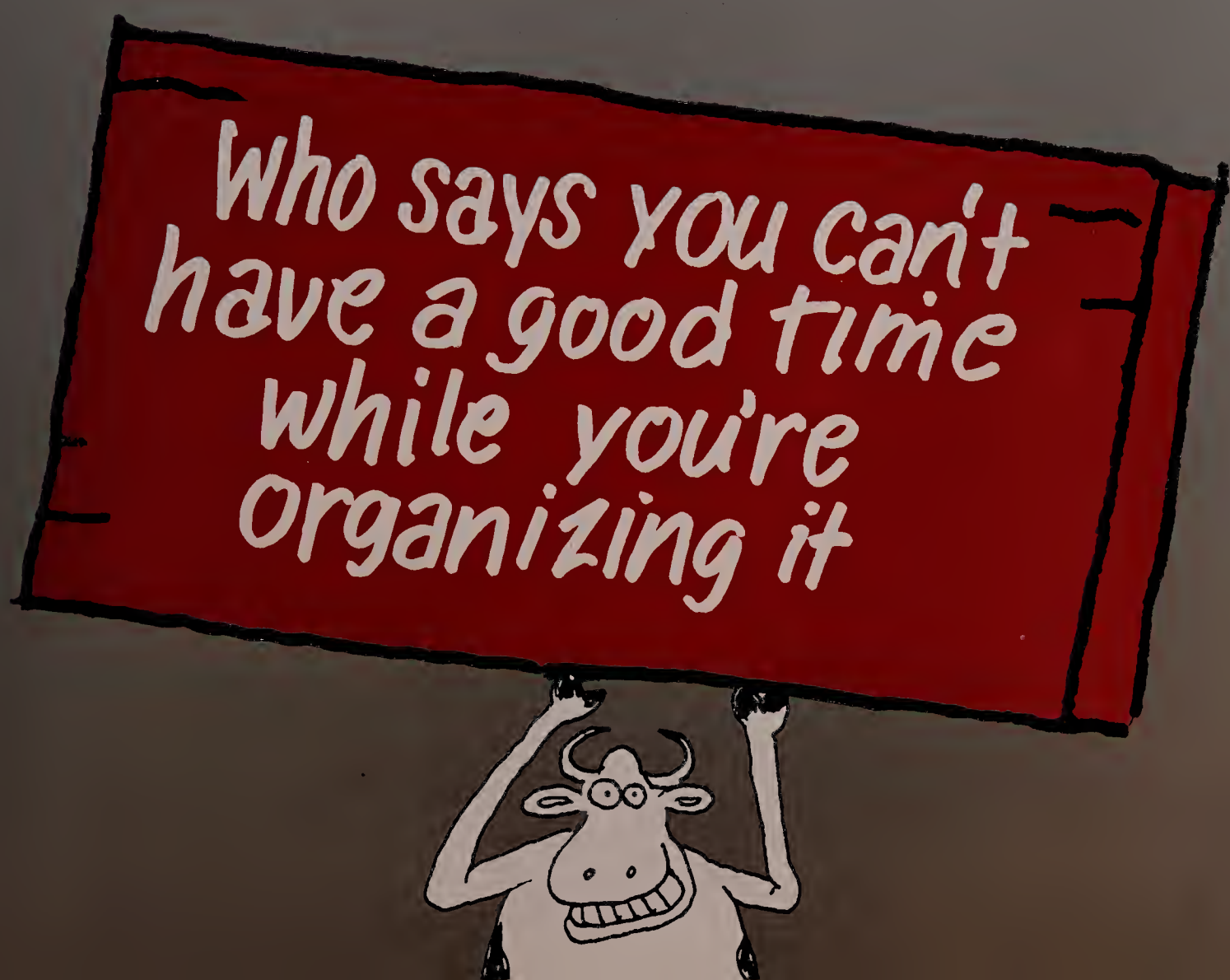
Want to equip *Procomm Plus* with the fast ZMODEM error-correction protocol? Download a copy of Omen Technology's *DSZ* from an on-line service or BBS (scan for DSZ0626.ZIP or DSZ0626.ARC).

Add the name of the directory in which you have put *DSZ* to your AUTOEXEC.BAT file's PATH command. Save the file and reboot. Then write the following two one-line batch files: ZMODEMD.BAT should consist of dsz t, and ZMODEMU.BAT should contain dsz sz %1 %2 %3 %4 %5 %6 %7 %8 %9.

Copy the two batch files to the *Procomm Plus* directory, and load *Procomm*. Press <Alt>-SP, and add zmodemu to the 'External protocol 1 upload filename' field. Cursor down to the next entry, 'External protocol 1 download filename,' and type zmodemd. Now exit the protocol screen, and save the new settings. The next time you want to upload or download a file, ZMODEM will appear on the *Procomm Plus* protocol menu.

***DSZ* is a $20 shareware package available from Omen Technology, 17505-V N.W. Sauvie Island Rd., Portland, OR 97231; 503/621-3735 (fax), 503/621-3746 (BBS).**

Judy Heim
Contributing Editor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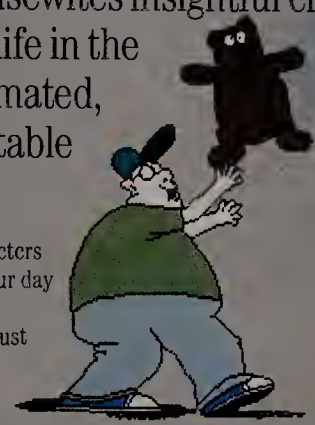

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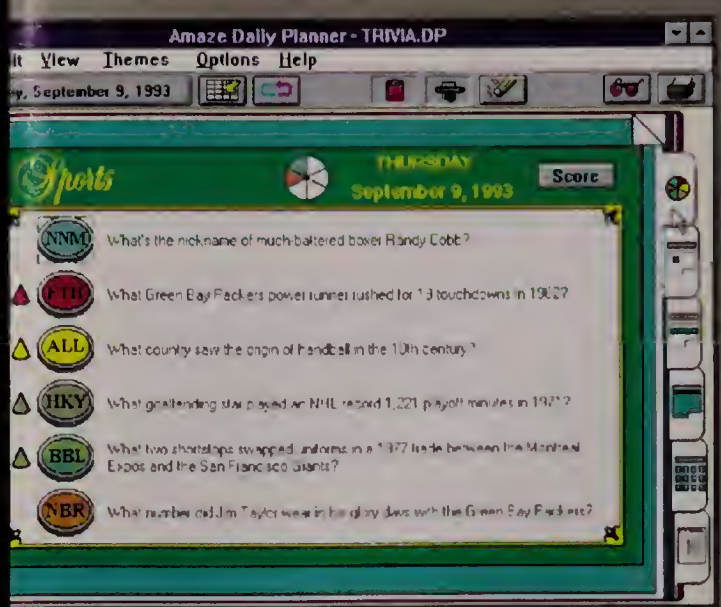

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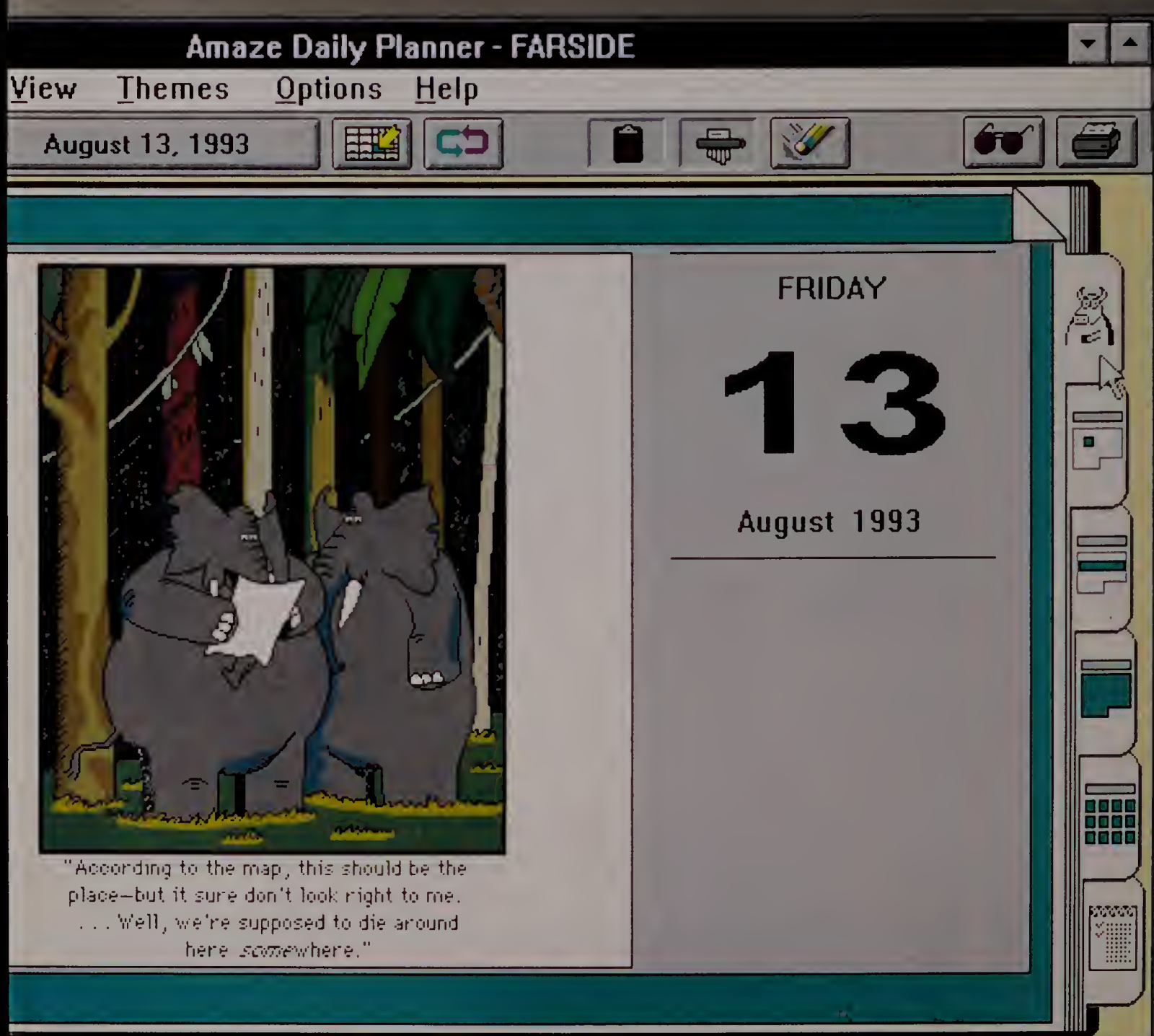

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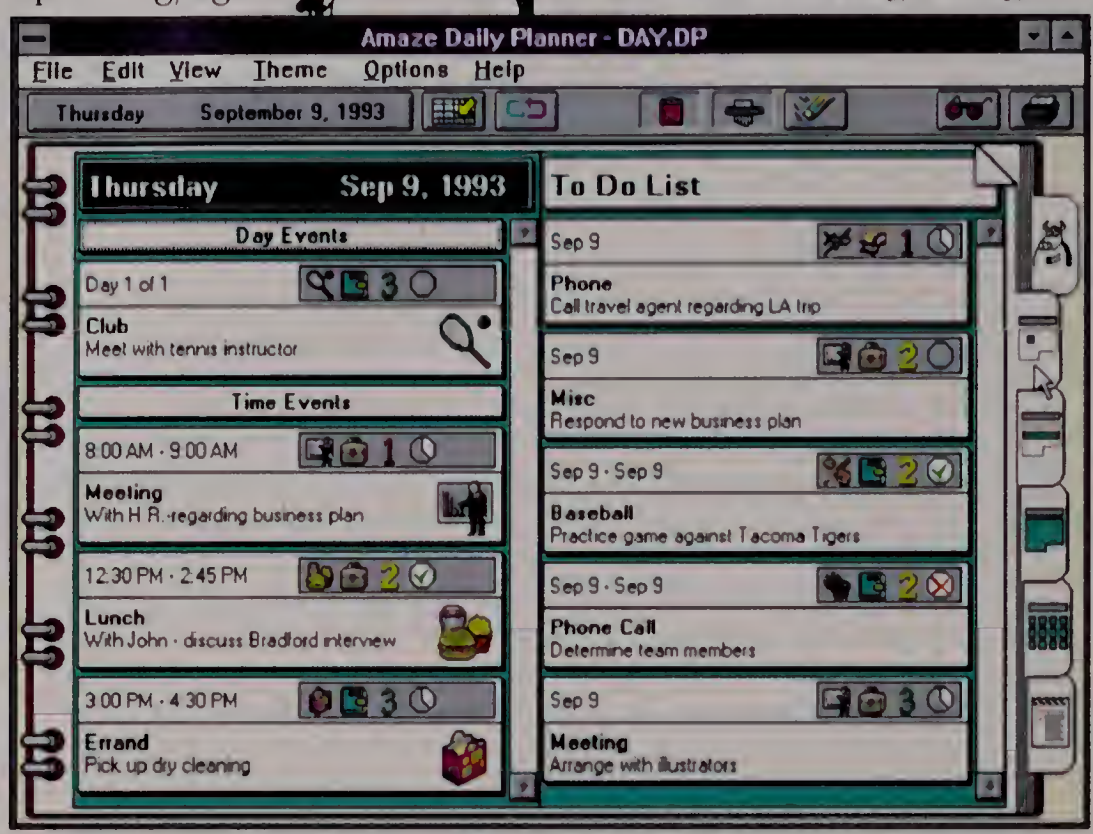

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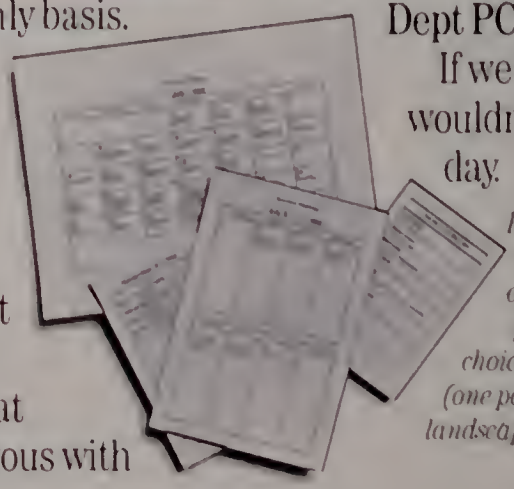

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WORD PROCESSING Q & A

Getting the Picture in WordPerfect

Q Even though I've used *WordPerfect 5.1* for a long time, I can't figure out how to bring the WPG clip-art files in my *WordPerfect* directory into my documents. The manual doesn't seem to help. Can you?
Devesh Chaturvedi
Portales, New Mexico

A You're not alone: Many *WordPerfect* users have trouble accomplishing this, due to the odd language in the Graphics menu.

Here are the steps you need to take to place a WPG file on the center of your current page, in that image's default size, with text wrapped around the graphic.

To import the file, press **<Alt><F9>**. The next step is where people tend to get into trouble. You want a graphic, but *WordPerfect* calls it a Figure. Press **FC** to insert a Figure box. Next, you'll see a menu. Press **F**, then type the WPG file's name and press **<Enter>**. If you don't know what the file name is, press **<F5>** to retrieve a file from a list. Then, with the figure menu still on screen, do the following (ignore any steps that don't apply to your needs):

1. If you want a caption, press **C**, then type your caption and press **<F7>**.

2. To anchor the image to a specific position on the page rather than to the current paragraph, press **TA<Enter>**. If you want the image to move when the surrounding text moves, press **TP<Enter>** instead.

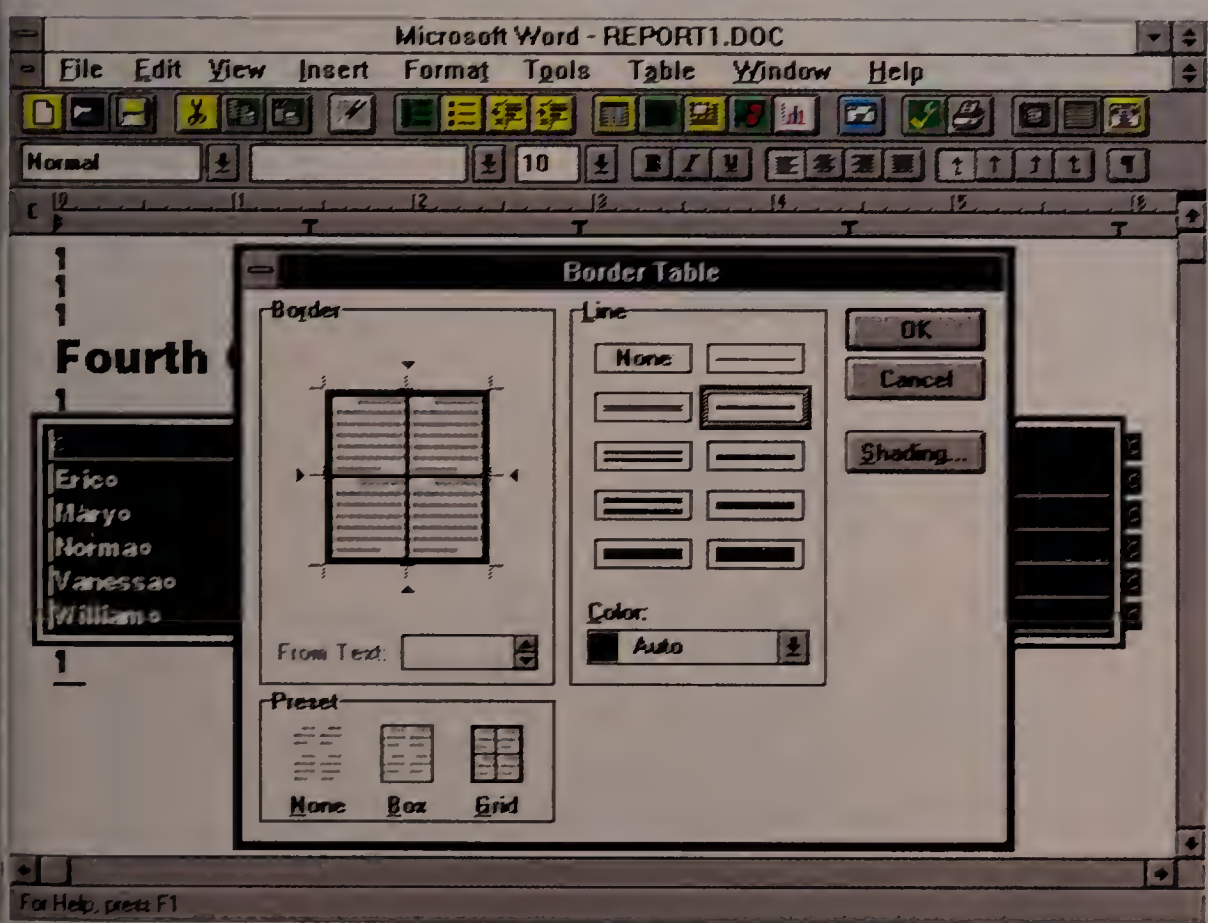
3. To center the image vertically, press **VC<Enter>**.

4. To center the image between your margins, press **HMC<Enter>**.

5. To show the image at its actual size, press **SA<Enter>**.

6. Press **<F7>** to complete the job. The graphic won't appear on the screen, but a box will mark its position. You can press **<Shift><F7>V** if you want to see a preview.

Once you've mastered the basics, you might take another stab at the manual's Graphics section. You can do a lot more with graphics, including scaling and rotating, but the steps here will get you off on the right foot.



You can print tables with gridlines of varying sizes, or add shading and color to Word for Windows tables using the Format • Border dialog box in the Table menu.

Making the Grid With Word for Windows

Q How do I get the gridlines in a *Word for Windows 2.0* table to print? Do you have any pointers?
Ashok Kumar, Northridge, California

A That's easy to do, but it's not an obvious procedure. Start by moving the cursor into the table. Then choose *Table • Select Table* or press **<Alt>-<Shift>-<Numpad 5>** (*Winword*'s Table menu shows an incorrect shortcut key for Select Table). Now select *Format • Border*. In the dialog box, click the Grid icon above the Preset area.

Your table will now have the default thin interior and slightly thicker outer lines. To change this setting, use the miniature sample table in the Border area. Click just outside the sample table, and then select a line style for the outer border in the Line box. Click inside the sample table and choose a line style for the interior lines.

For even more flexibility, you can select and format individual lines in the sample table. In the same dialog box, you can also choose line colors and shading. When you're finished, click *OK* and print.

Shady WordPerfect Characters

Q I need to create text with background shading in my *WordPerfect 5.1* documents. I know that my printer can handle shading, but I can't get *WordPerfect* to cooperate with me. What's the trick?
Jim Zezza, Wilkes-Barre, Pennsylvania

A There's no trick, but because the *WordPerfect* manual describes commands rather than functions, it's easy to get confused. You can use *WordPerfect*'s Text Box feature to produce background shading with any graphics-capable printer. Here's a step-by-step approach:

1. Position the cursor where you want the shaded text, then press **<Alt><F9>BO**. You'll see the text box options menu.

2. Press **G**, type the percentage of gray

you want as a background (10 to 25 percent works best), then press <F7> twice to return to the editing screen.

3. To create the text box, press <Alt>-<F9>BC>. In the menu, select the size, horizontal and vertical position, text wrapping, and other details, then press E to enter text.

4. Type your text, using regular *WordPerfect* formatting commands. Then press <F7> twice. Once you move the cursor, you'll see an empty box on the editing screen.

That's basically it. Your shaded box of text won't appear on the normal editing screen, but you can see a preview with the command <Shift>-<F7>V.

Note: If you need to edit the shaded text, or change the shading percentage or other text box attributes, press <Alt>-<F3> to open the Reveal Codes window. Then move your cursor to the text box marker in the window and press <Alt>-<F9>BE<Enter>. Use the menu to make your changes.

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ASCII Conversion From Windows

Q I use *Ami Pro 2.0* for all my word processing, including the preparation of messages I send on MCI Mail. But when I save the file in ASCII format to send over MCI, the lines are too long, so I get an error message when I try to send the file. Is there an easy fix for this, or must I go back to using a DOS word processor?
Stephen Jameson, Orinda, California

A You would encounter the same problem with any *Windows* word processor you use, because *Windows* itself uses proportional fonts. Because character spacing isn't fixed, some lines in your document may end up being longer than MCI Mail is able to accept. The following solution will work in *Ami Pro, Word for Windows,* and *WordPerfect for Windows.*

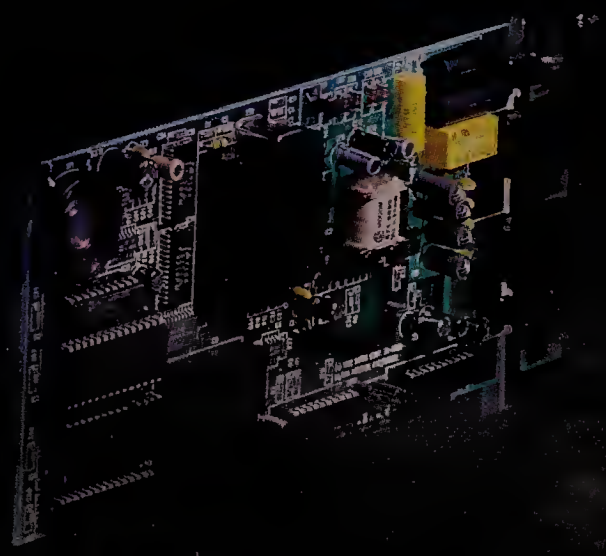
Regardless of which word processor you use, before you begin typing your text, switch fonts to 12-point Courier but leave your program's default margins in place. This font will emulate the fixed-width fonts used in DOS and keep your lines at the proper length. If you write a lot of E-mail messages and get tired of having to change the font, create an E-mail style that sets the font for you.

USER GROUP TIP

WordPerfect Spell Check

When I had to interrupt *WordPerfect's* spelling checker, the program wouldn't let me resume where I'd left off, at least until I discovered a work-around: Get to where you'd like to start the spelling check, start the block command with <Alt>-<F4> or <F12>, and then hit <Home> <Home><Down> to go to the bottom of the document. While Block is still on, start the spelling check with <Ctrl>-<F12>. *WordPerfect* will check your text from the beginning of the block down. You can even use the macro recorder to automate the job.

Arno Seegers
Las Vegas PC Users Group



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When you're done, select *File•Save As*, type in a file name, then do the following:

If you're using *Ami Professional 2.0:* in the *File type* list, select *ASCII*. Click the *ASCII Options* button and select *CR/LF at lines*. (This option will become the default.) Then click *OK* to save the file.

For *Word for Windows 2.0:* in the *Save File as Type* list, select the *Text Only w/line Breaks (*.txt)* option, then click *OK*.

For *WordPerfect for Windows:* in the *Format* list, select the *ASCII Text (DOS)* option, then click *Save*.

Once you've saved your file, you can send it on MCI Mail, through your E-mail, or via any other service.

Killing Files in Word for Windows

Q I use *Word for Windows 2.0* constantly, and would like to be able to preview and delete files in the application without having to switch to the File Manager. Does *Word for Windows* offer a way to accomplish these chores?

Terry LeRoy Coleman
Inglewood, California

A In November 1992's *Star-Dot-Star* column (which now goes by the name *Dialog Box*), we offered a simple macro for quickly deleting files from within *Word for Windows*. For loading, previewing, copying, *and* deleting files, however, you'll achieve the best results by using *WinWord 2.0*'s quite capable file management system, which many users don't know about. Here's how to proceed:

Select *File•Find File*. If the file you want is in your current directory and is a *WinWord* document, its name will appear in the list box. Click on a file name to bring up a preview of the document in miniature, and select *Delete* to delete the file. You won't be able to delete any files currently loaded into *WinWord*, however. To select more than one file for deletion, hold down the <Ctrl> key while you click on the file names.

If the file or files you want to preview or delete aren't listed in your current directory, you'll have to go a bit further.

As before, select *File•Find File*, then select *Search*. In the Search dialog box, click the *Edit Path* button. In the Edit Path dialog box, navigate the tree in the Directories box—you may need to change drives in the Drive box in the process—to highlight the directory you want to search. Then click the *Add* button. You can add more directories to the Search Path box if you want to. Then click *Close* or press **<Esc>**. Back in the Search dialog box, select *Start Search*. When *WinWord* finishes the search, you'll return to the Find File dialog box, where you can delete any files in the list.

By George Campbell

Mail your word processing questions to Word Processing, PC World, *501 Second St. #600, San Francisco, CA 94107; or send them electronically to PC World Online, PCW George or Word Processing; CompuServe, 71571,222; MCI Mail, GCAMPBELL; or 415/442-1891 (fax).* PC World *pays $50 for published questions. Sorry, we cannot acknowledge unpublished materials.*

George Campbell is a contributing editor for PC World.

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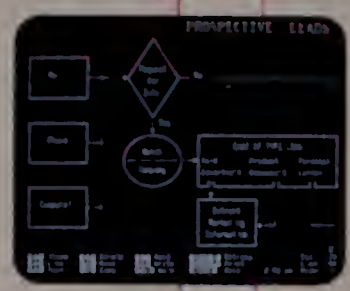

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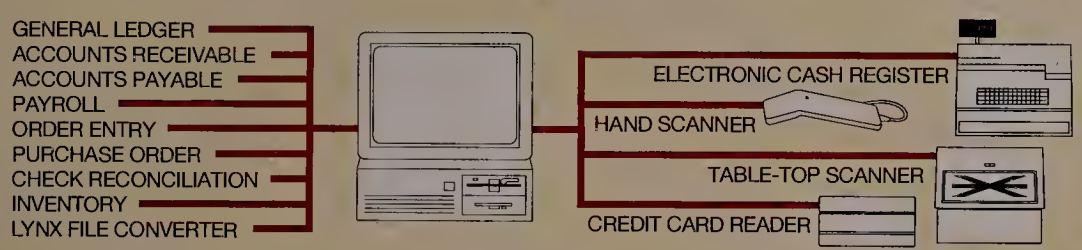

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WINDOWS Q & A

Sound Advice

Q I downloaded the PC speaker driver from Microsoft's BBS so I could play WAV sound files in *Windows 3.1*, but for some reason, the sound got cut off after about 3 seconds. What's wrong?
Mark Watson, Denver, Colorado

A You need to change the sound driver's setting from a default of 3 seconds to a longer duration. Open Control Panel and double-click the Drivers section. Select the Sound Driver for PC-Speaker and click the Setup button. When you move the Limit scroll box's indicator to the far right, your WAV sounds will play without interruption.

PC World Online offers dozens of WAV files you can download for free. Check in the Software Library's "WAV and BMP" folder. Those who don't have the PC speaker driver yet can get it from the Microsoft Download Service (206/637-9009 or 206/936-6735 for 9600-bps access) or from PC World Online in the Software Library's "Featured in December!" folder.

Cardfile Guile

Q I can't find a way to print *Windows'* Cardfile to a DOS text file or access it in readable form with a word processor. Surely Microsoft wouldn't omit such a critical function, would they?
Harriet Roland, Las Vegas, Nevada

A They would, and they did. But you can accomplish this task indirectly. First, from Program Manager, launch Control Panel, double-click *Printers*, and click *Add*. Select the *Generic / Text Only* printer and click *Install*. If you haven't already installed this printer driver, you may need to feed your PC some of your *Windows* floppy disks.

When you're finished, the Generic / Text Only printer should appear in the list of Installed Printers at the top of the dialog box. Select it and click *Connect*. Select the *FILE:* port and click *OK*. Click *Close*, then exit Control Panel.

Now launch Cardfile and open the file you want to convert to text. Choose *File•Page Setup*, eliminate headers and footers, set margins to zero, and click *OK*. Choose *File•Print Setup*, select *Generic / Text Only on FILE:* from the Specific Printer list, and click *OK*. Choose *File•Print All*, enter a path and file name in the Print To File box, and click *OK*. You can now open your new text file in any word processor and retouch the text to suit your needs.

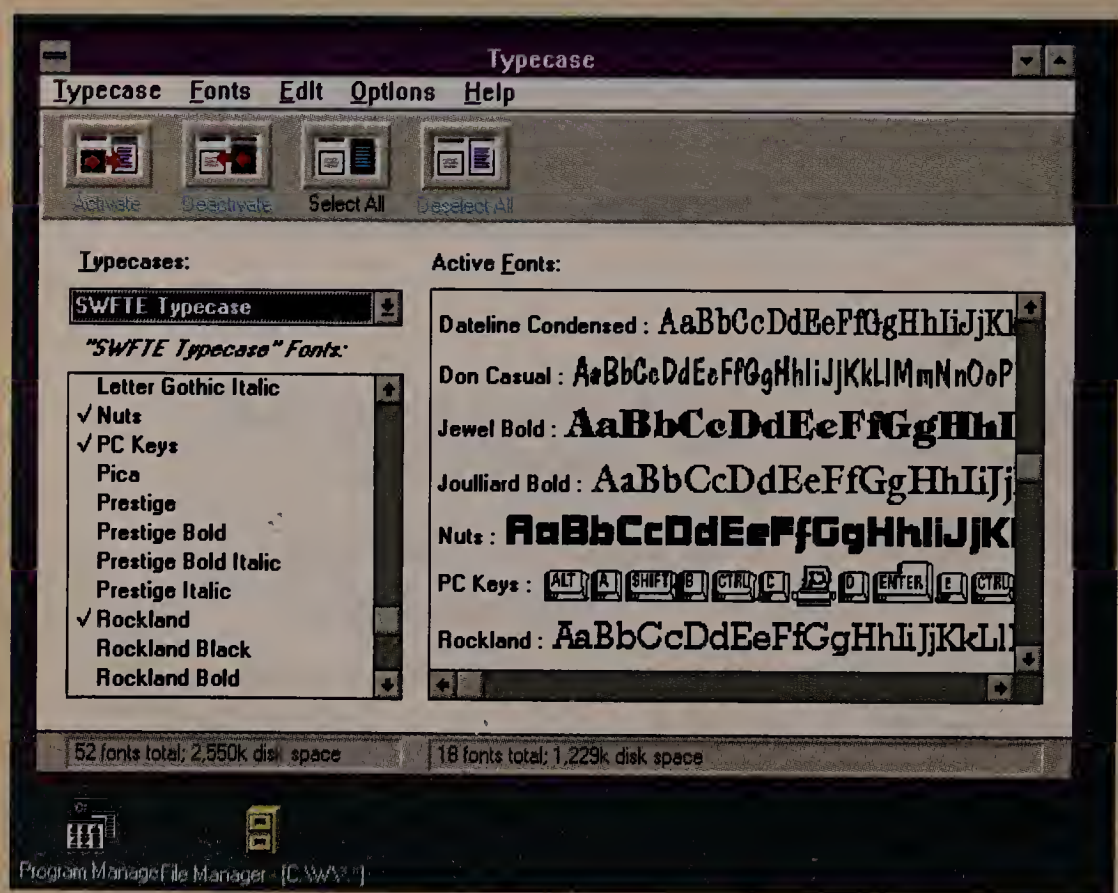
One note: The Generic / Text Only driver is incompatible with *Adobe Type Manager*. If you use *ATM*, you will have to open its control panel, turn it off, and restart *Windows* before you can print to a file with this method.

Protecting Your Properties

Q To reduce training time and establish consistency, we installed *Windows* on each workstation in our office, but we share program icons by storing one set of GRP files on a network drive. If I change the property of a program item, my changes aren't saved unless I'm the last person to exit *Windows* that day. Is there a way around this?
Subhash Mukhopadhyay
Jenkintown, Pennsylvania

A For all but the most informal work groups, control of the office interface should be the responsibility of a small number of people, presumably those who manage the network. People who share a networked PC also may want to build in *Windows* security. In either case, if you use *Windows 3.0*, the simplest solution is to make the GRP files

Windows Toolbox



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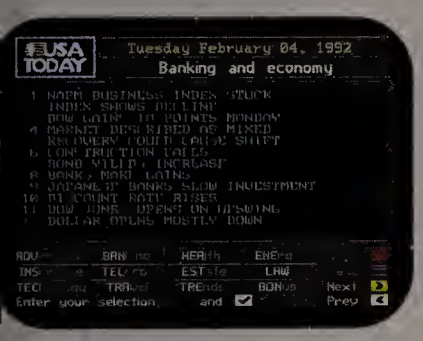

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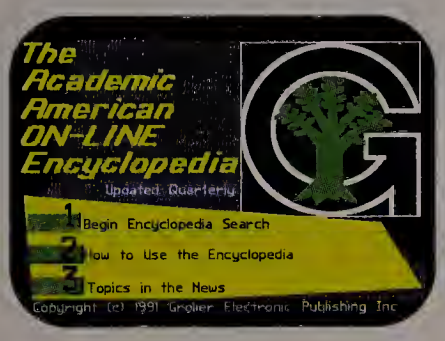

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read-only. Attempts to change program item properties will prompt an error message. Users can move icons or resize or move groups but will get a similar error message if they try to save changes upon exiting. To avoid these messages, tell your staff to leave the icons alone and uncheck the Save Changes box when exiting *Windows*.

If you use *Windows 3.1*, you can make the process more sophisticated. Open PROGMAN.INI in Notepad and add a section called **[restrictions]** (including brackets). Under that heading, add the line **NoSaveSettings=1** to disable the *Save Changes on Exit* command in the Options menu. This ensures that the arrangement of windows and icons will always be the same.

If you wish to prevent your staff from launching other applications from the File•Run command, add the line **NoRun=1**—or even **NoFileMenu=1**, which removes the File menu from Program Manager. To stop users from invoking File Manager's Run command or launching programs by double-clicking application or data file names, delete the File Manager icon.

Other lines give you even more customization control over Program Manager. **EditLevel=1** prevents users from creating, renaming, or deleting program groups; **EditLevel=2** removes the ability to create or delete program items. To these restrictions, **EditLevel=3** adds protection against changing the command lines of program items. **EditLevel=4** includes all these restrictions as well as preventing any change to program item properties: Users can view properties but make no changes.

If you want to prevent users from exiting *Windows*, add the line **NoClose=1**.

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USER GROUP TIP

Safety in Windows

Installation programs usually ask permission before changing my AUTOEXEC.BAT and CONFIG.SYS files, but they're rarely so polite about the INI, INF, and GRP files that define the *Windows* environment. That's why I protect my setup with SAVENV.BAT (before you can use it, you must create a directory called \ENVWIN):

```
ECHO OFF
CLS
ECHO Y | DEL C:\ENVWIN\*.* > NUL
COPY C:\WINDOWS\*.INI C:\ENVWIN
COPY C:\WINDOWS\*.GRP C:\ENVWIN
COPY C:\WINDOWS\*.PIF C:\ENVWIN
COPY C:\WINDOWS\SYSTEM\*.INF
  C:\ENVWIN
ECHO Windows' environment saved
```

Run the batch file before you install a *Windows* application, and SAVENV.BAT will copy all your important *Windows* environment files to a safe, out-of-the-way place. Later, if you discover that a change has corrupted the *Windows* environment, you're set to start copying your files back one at a time to determine what's causing the problem.

Kenny Wynn
Las Vegas PC Users Group

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any of these restrictions by removing a given line or setting its value to **0**.

No 32-Bit Access

Q I was changing the size of my permanent swap file in Control Panel and checked the Use 32-Bit Disk Access box, assuming it would speed up my system. Now *Windows* won't start at all. How can I get back into *Windows* to undo this?
Lee Robinson, Cambridge, Massachusetts

A *Windows 3.1*'s 32-bit access option (also known as FastDisk) lets you load more non-*Windows* applications and speeds things up when you run non-*Windows* applications in the background. It does this by bypassing the system's BIOS and talking directly to the hard disk controller. The drivers that make this possible work only with standard Western Digital 1003 or ST506 controllers or compatibles. The good news is this covers about 90 percent of the hard drive controllers in use; the bad news is you belong to the unlucky 10 percent.

You can solve your problem if you have a non-*Windows* text editor like DOS 5.0's EDIT. Open the SYSTEM.INI file, which is found in the same directory as *Windows*, and search for '32BitDiskAccess=on'. Edit this line so it reads **32BitDiskAccess=off**. Then save the file in its original text-only format and start *Windows*.

Start *Windows* by typing **WIN /D:F** at the DOS prompt. This disables FastDisk for that session, allowing you to return to Control Panel to correct your problem. Open the 386 Enhanced section. Click the Virtual Memory button and the Change button. Uncheck the Use 32-Bit Disk Access box and click *OK*. Respond to the ensuing messages to confirm and restart *Windows*. You don't need to delete files, and your PC will run at least as well as it did under *3.0*.

A Cleaner DOS Box

Q When I opened a DOS-prompt window under *Windows 3.0*, I got the basic C> prompt, which is what I wanted. But in *3.1*, I get a box of instructions telling me how to return to *Windows*. How can I stop those instructions from appearing each time I double-click on the DOS icon?
Walter Swenson
Steamboat Springs, Colorado

A Begin by making a backup copy of your SYSTEM.INI file. Open *Windows* System Configuration Editor by choosing *Run* from Program Manager's File menu, typing **SYSEDIT**, and pressing **<Enter>**.

Click on the SYSTEM.INI window, and under the heading [386Enh], add the line: **DOSPromptExitInstruc=0**. Then save SYSTEM.INI and restart *Windows*.

By Scott Dunn

Mail your questions to Windows, PC World, *501 Second St. #600, San Francisco, CA 94107-1431; or send them electronically to PC World Online, Windows; CompuServe 74055,412; MCI Mail, 179-3813; or 415/442-1891 (fax).* PC World *pays $50 for published questions. Sorry, we cannot acknowledge unpublished materials.*

Scott Dunn is a contributing editor for PC World *and coauthor of* 101 Windows Tips *(Peachpit Press, Berkeley, California, 1992).* ■

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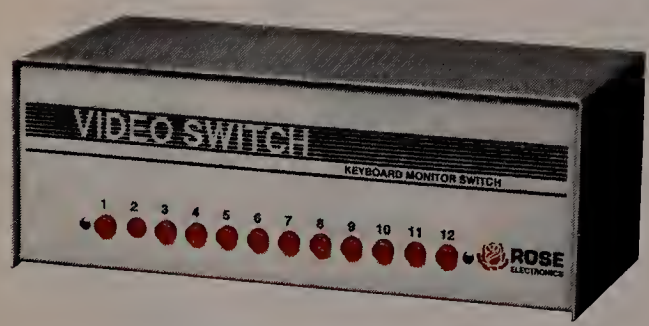

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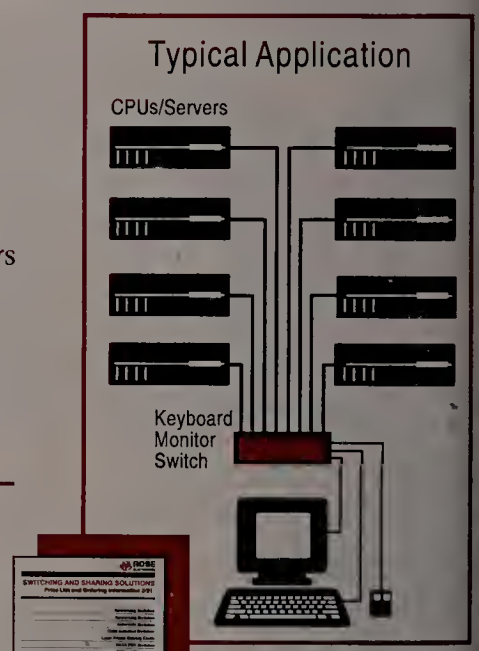

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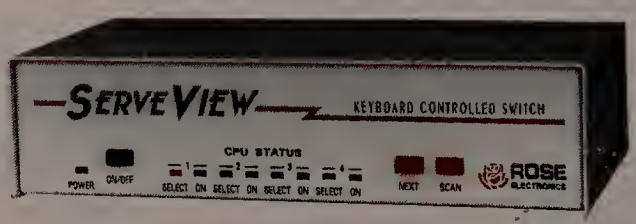
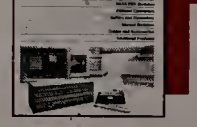


Keyboard controlled unit



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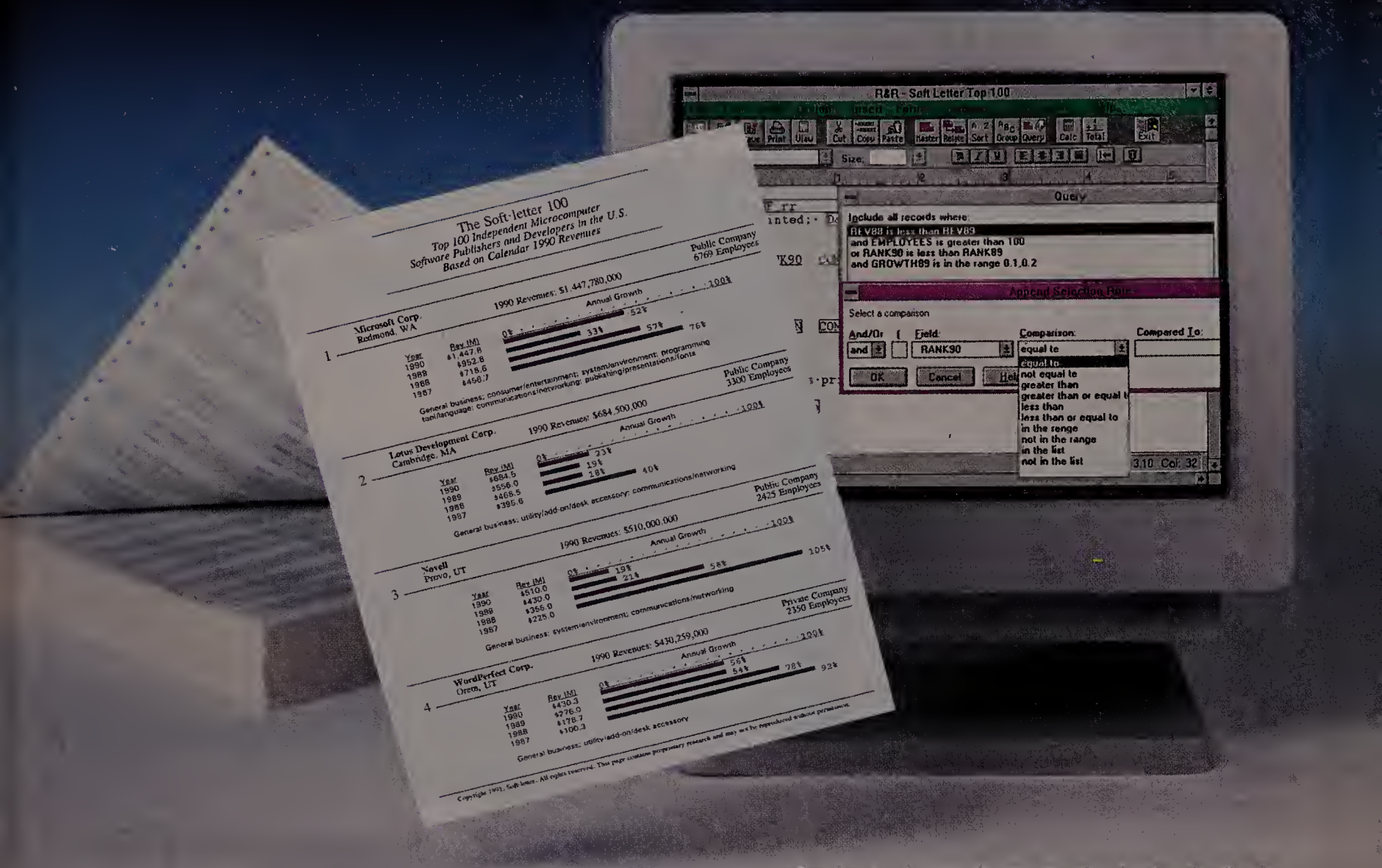

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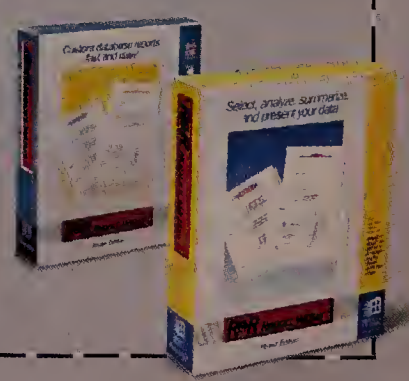

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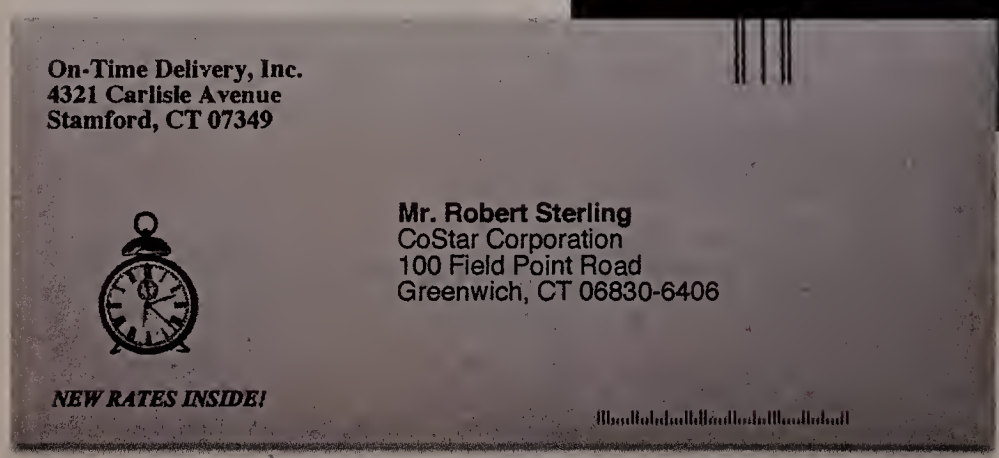

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5	○	○	○	○	○	○		○	○	○	○
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9	○	○	○	○	○	○		○	○	○	○
0	○	○	○	○	○	○		○	○	○	○

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Word Processing (page 343)	○	○	○	○	○	○	○
Windows (page 350)	○	○	○	○	○	○	○
Dialog Box (page 391)	○	○	○	○	○	○	○
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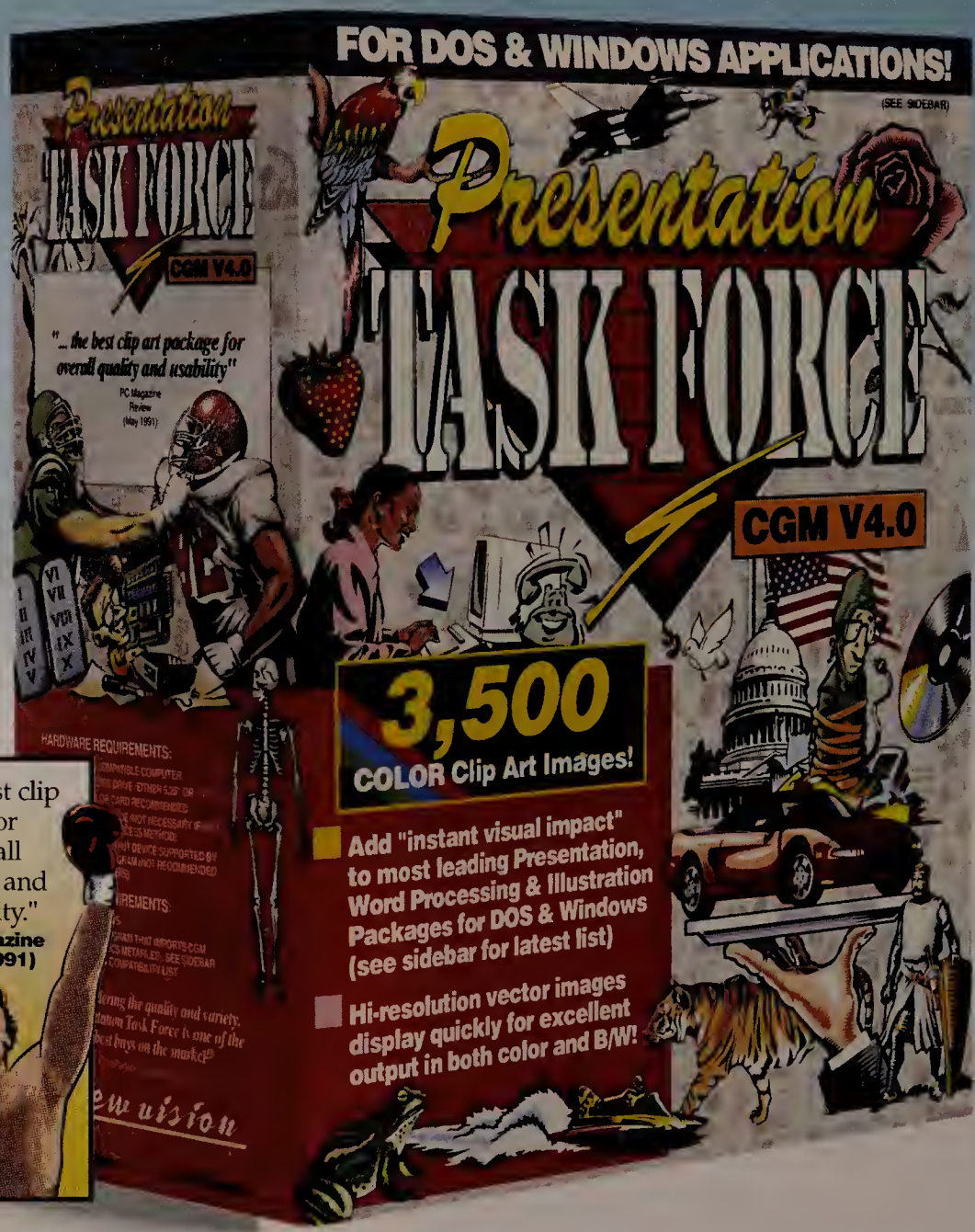

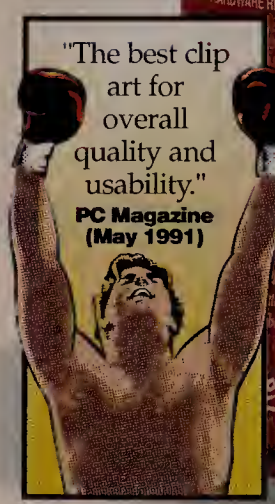

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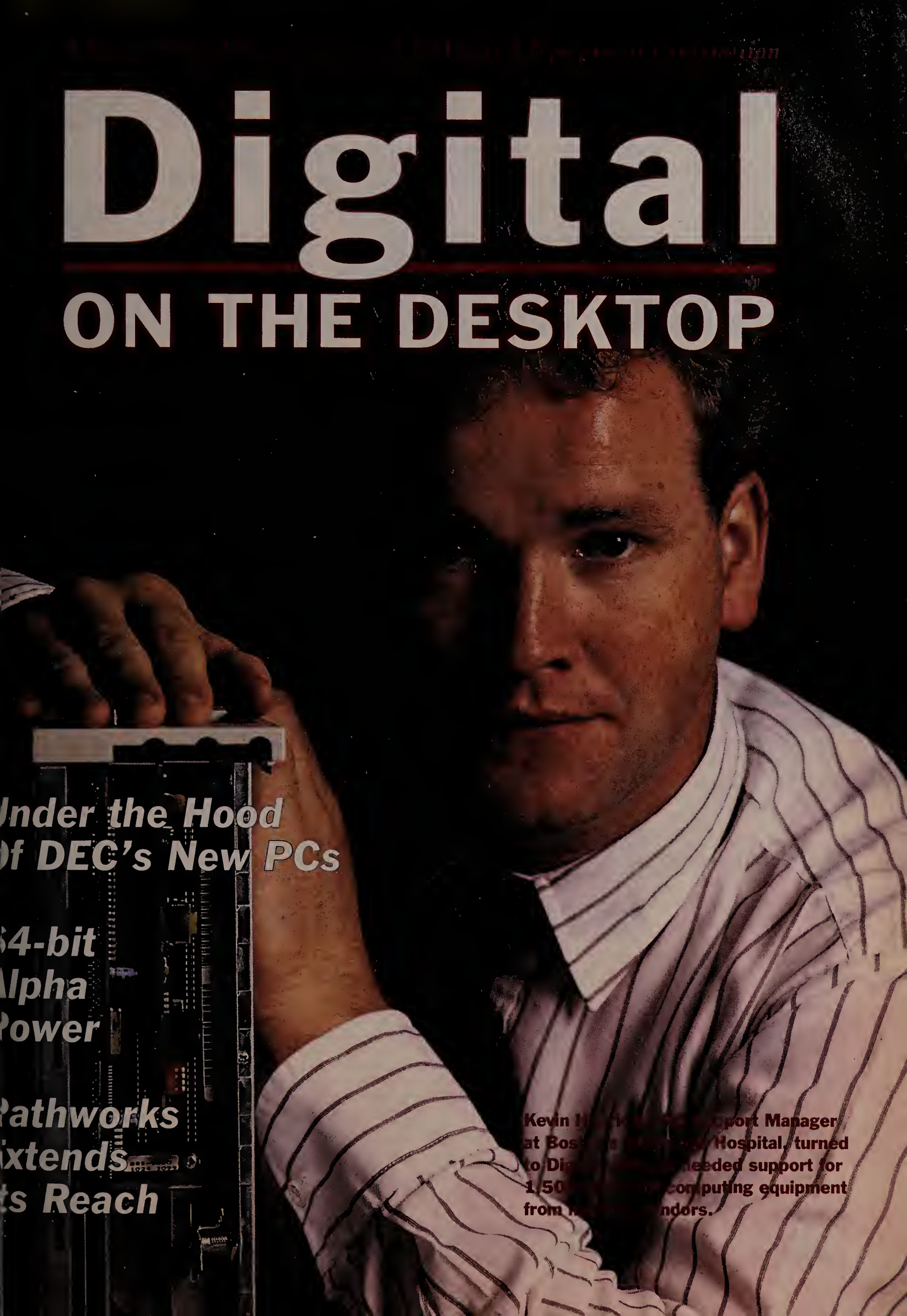


Under the Hood of DEC's New PCs

64-bit Alpha Power

Pathworks Extends Its Reach

Kevin [illegible] Support Manager at Bos[illegible] Hospital, turned to Di[illegible] needed support for 1,50[illegible] computing equipment from [illegible]ndors.

JULY 1992, PC MAGAZINE DESCRIBES THE PERFECT PC.

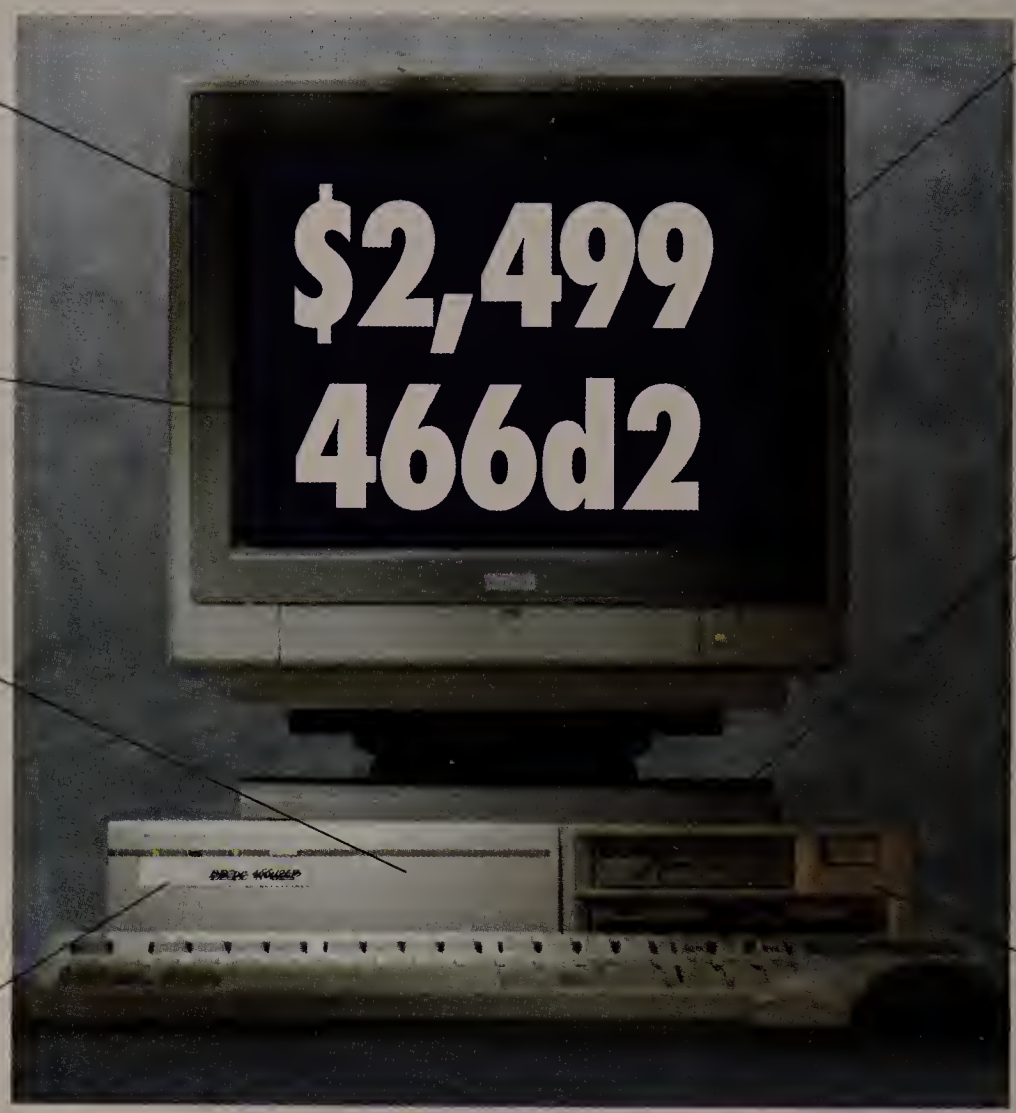
SEPTEMBER 1992, DIGITAL MANUFACTURES IT.

"...if your ultimate PC system runs Windows, an accelerated VGA card can boost performance to 3 to 20 times that of a dumb frame buffer."

"For the utmost in display speed, look at local bus designs..."

"A high scale of chip set integration lowers cost and improves system reliability..."

"To save space, look for built-in parallel and serial ports, and IDE and video circuitry."



"Display adapters usin VRAM...are often twi as fast as DRAM-base boards."

"To take advantage o a 32-bit operating system such as OS/2 2.0 or Windows NT (when it ships), you w want at least 8 MB o RAM, so a 16 MB motherboard may prove limiting in the next couple of years.

"Note that metal SIM sockets are preferab to plastic ones."

DECpc™ 466d2 LP 486DX2 66 MHz System
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Digital Sizes Up the Desktop

This special supplement, prepared for Digital Equipment Corp. by editors and writers of the International Data Group, is meant to focus attention on the technologies and services Digital offers on the desktop.

While starting from a relatively small base, Digital has become one of the fastest growing vendors of PC hardware this year. In addition, Digital officials say revenues from its PC networking product, Pathworks, will soon overtake revenues from DEC's mainline VMS operating system.

DEC approaches desktop connectivity from the server down rather than from the desktop up – given its experience with wide area networking – and is seeking through Pathworks to provide a layer of integration services above the stand-alone PC.

To examine these technologies, we have organized this supplement into four sections: PC hardware, PC integration services, workstations, and X terminals/dumb terminals/other desktop services.

Desktop mainframe? Digital's 64-bit Alpha workstation.

In the first section we try to explain how Digital can claim to speed up Microsoft Windows and ask both inside and outside sources how Digital is doing as a PC vendor.

In the second, Kevin Hourican of Boston's Children's Hospital and Nina Lytton of the Open Systems Advisor newsletter, explain how they use DEC's integration services.

In the third, workstation guru Don Gaubatz talks about the future of Digital workstations, then illustrates it by teleconferencing via his desktop machine.

The fourth section touches upon how dumb terminals aren't so dumb anymore and how a software architecture called DECprint can allow you to initiate a two-way conversation with a remote printer. ■

Service and Low Prices Fuel DEC's PC Sales Growth

In January, Digital Equipment Corp. unched a massive direct marketing and ail-order PC sales program, slashing ices 50 percent. In its determination to mpete, Digital cut prices an additional) percent in February and again in July. The aggressive marketing and pricing pear to be paying off. Digital was the stest growing PC vendor in the country May and June and five times this year is appeared among the top 10, according Computer Intelligence, a La Jolla, alif., market research firm.

"Digital has stayed on the Up-and-oming PC Vendors list longer than iyone in recent history," noted Dan ess, senior industry analyst at Comiter Intelligence, of Digital's five-onth appearance there. In July it opped out of the number one slot to umber five, being replaced by Cumus Computer.

In fact, Digital's overall PC sales for e fiscal year ending June 30 were 275-rcent greater than its PC sales during e previous year, sources at the company aimed. InfoCorp of Santa Clara, Calif., acks PC sales and says Digital sold 34,700 worldwide in the first six onths of calendar 1992, compared to),660 for all of 1991. In the U.S. alone, e figures were 59,767 for the first half 92 compared to 31,105 for 1992, according to analyst David Carnevale.

However, reports of rapid growth of PC hardware sales are based on increases in a relatively small installed base. Digital barely cracked the top 20 in overall sales and it accounts for slightly more than 1 percent of the domestic PC market, according to Ness.

On the other hand, Digital's revenues from PC-related sales of software and networking like Pathworks, its PC-to-host and LAN-to-WAN package, boost its total revenue take. InfoCorp estimates DEC PC revenues, including software and peripherals as well as hardware, at $423 million in the first half of 1992, compared to $261 million in 1991. PC-related sales are one of Digital's fastest growing areas of revenue, analysts said.

PC market share
in percentage as of July 1992

IBM	17
Apple	12
Compaq	6
Dell Computer	5
Gateway 2000	5
DEC	1
Other	54

Source: Computer Intelligence

Digital's effort through the first half combined the competitive pricing strategy of fast-growing PC makers such as Dell Computer Corp. with free, onsite service for a year and the Desktop Direct, 1-800-PC-BY-DEC, quick delivery number. Since Aug. 25, it has been offering its Low Profile line of PCs that it manufactures itself with a modular, snap-in-CPU upgrade capability.

"The sales reps know the products and can explain them in a way that makes sense," said Mike Luckenbach, an MIS manager at Asea-Brown-Boveri, a Windsor, Conn., electrical power systems and nuclear fuel manufacturer.

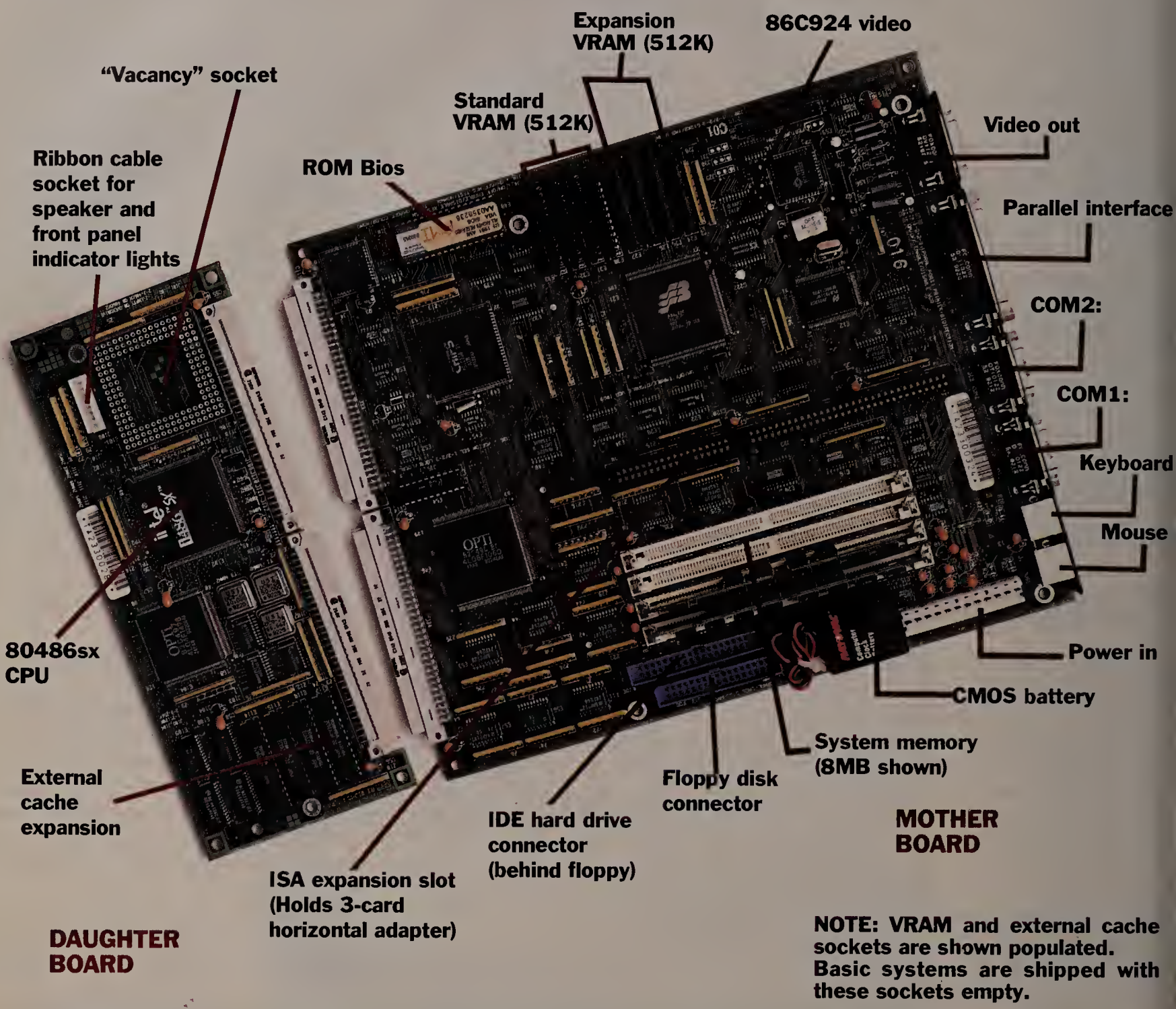
Through Desktop Direct, Digital has increased the company's customer base by more than a third, said John MacGilvary, Digital's U.S. PC sales and marketing director.

On June 26 Dell reduced prices on a line of PCs, prompting other clone makers, including Advanced Logic Research Inc. and Hyundai Electronics, to follow suit. Digital's latest cuts came soon after. It likewise priced its LP line of PCs aggressively.

Both MacGilvary and Computer Intelligence's Ness believe Digital's reputation as a service provider rather than low prices has fueled the accelerated growth in PC sales. "Right now we're the only manufacturer delivering our own onsite support services," he said. Clone makers supply a similar service through third parties like TRW. Ness added, "It's hard for a smaller company to offer that kind of service." ■

Cover Photo Copyright 1992 by Seth Resnick
Design: David Grober and Thea Shapiro

Inside the 425sx LP



NOTE: VRAM and external cache sockets are shown populated. Basic systems are shipped with these sockets empty.

DECpc 425sx LP technical reference

(Note: Many of these features are common to the other units in the LP line)

CPU: 80486SX at 25 Mhz

Standard Memory: 4-MByte system memory; 512-KByte virtual RAM video memory

Maximum Memory: 64-MByte system memory (8 MBytes as evaluated); 1 MByte VRAM video memory*

External Cache: 128 KBytes; expandable to 256 KBytes*

Jumper System Clock: 25*, 33, 40, 50 Mhz

Storage: 122-MByte IDE hard disk; 1.4-MByte, 3.5-inch floppy disk

Video: SVGA-compatible adapter with graphics accelerator on mother board

I/O: All I/O on mother board: IDE and floppy controllers, two serial ports, one parallel port and one mouse port

Expansion: 3- x 16-bit, full-length ISA slots

Internal Drive Bays: Two (one free in basic configuration)

External Drive Bays: Two (one free in basic configuration)

Case: 3.5 x 16.1 x 15.6 inches (90mm x 410mm x 396mm)

Standard Software: MS-DOS 5.0, Microsoft Windows 3.1, DiagSoft QAPlus diagnostics, drivers and system utilities

System BIOS: Phoenix

Video BIOS: AMI

Power: 145 Watt, auto-sensing supply with 100-240VAC input

Warranty: One-year, money-back guarantee

Maintenance: 1-year on-site maintenance

**Configuration as evaluated*

DEC's New PCs

Low Profile line speeds up Windows and offers modular upgrade capability

By TOM BADGETT

Digital Equipment Corp.'s 425sx LP is among the front runners in the company's new line of high-performance, low-cost, upgradeable PCs.

Notice the individual components of that description. The LP in the product name stands for low profile, a reference to the narrow case that makes this line of PCs look more like terminals than PCs.

The high-performance part refers not only to the 25-Mhz 80486sx CPU that drives this machine, but also to an internal design that runs some programs specially applications for Microsoft Windows – faster than competitive hardware. Screen updates for the typical Windows application running on an LP PC will be four times faster, and WordPerfect will be up to 10 times faster.

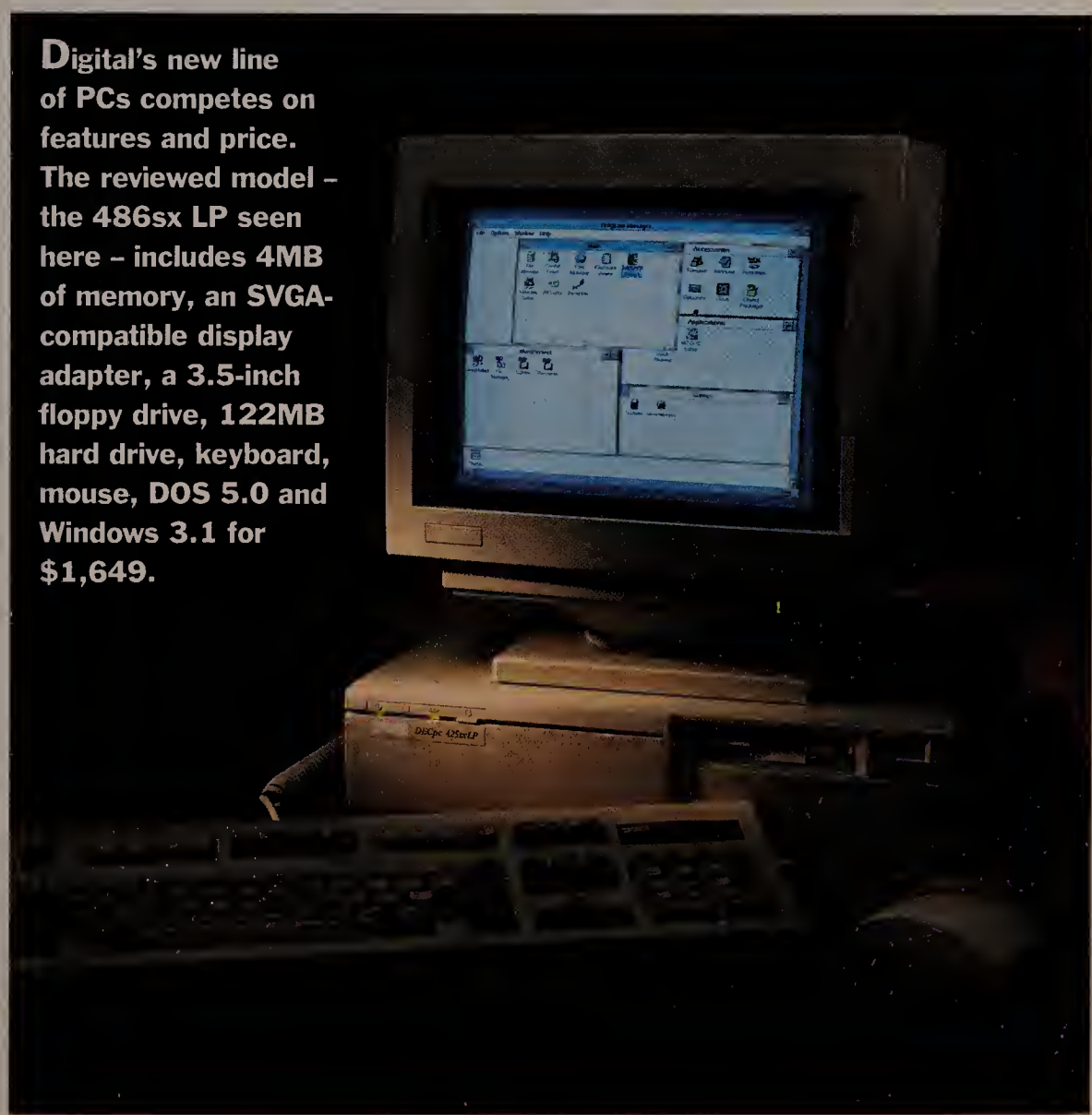
This speed is achieved by using a graphics accelerator and local bus video to connect the video processor directly to the CPU. That means the video-to-CPU communications are conducted at the CPU speed – 25 Mhz in the case of the 425sx LP – rather than at the much slower 8 Mhz of the conventional PC I/O bus. (*See accompanying story on video technology, page 7.*)

And, low cost means what it says. Although the Digital of yesterday was not known for competitive prices, this new line of PC offerings is competitive in features and price. The 486sx LP package, for example, includes 4 MBytes of memory, an SVGA (Super Video Graphic Array)-compatible display adapter, a 3.5 inch floppy drive, 122-MByte hard drive, keyboard, mouse, DOS 5.0 and Windows 3.1 for $1,649. Similar LP packages range from $899 for an 80386-based system to $2,199 for a 66-Mhz, 80486-based system.

All one needs to get these systems up and running is a video display, also offered by Digital and available from a number of third-party suppliers as well.

The LP line includes a range of processor options, from the low-end 80386sx to the high-end 66-Mhz 486. The machine we evaluated used a 25-Mhz 80486sx. The 486sx is a replacement for the 386DX microprocessor, the high-end chip in the previous processor line. The 486sx chip is a scaled-down 486DX. The DX model includes internal math co processor circuitry; the sx doesn't. The original concept of this design was to provide users who do not need high-speed math operations with a lower-cost alternative to the DX chip. An obvious application for this type of chip would be in a network server, for example, where resource and application sharing are more important than number crunching.

The marketplace has chosen broader applications for the lower-cost 486 chip, however. The 486sx certainly is not relegated to just server applications. And the reduced complexity of the sx-series chip lowers system cost enough to make it an especially attractive choice for applications that require reasonable speed, technology compatibility and the lowest possible cost.



Digital's new line of PCs competes on features and price. The reviewed model – the 486sx LP seen here – includes 4MB of memory, an SVGA-compatible display adapter, a 3.5-inch floppy drive, 122MB hard drive, keyboard, mouse, DOS 5.0 and Windows 3.1 for $1,649.

Photos by Rhea Rippey

The 486sx series uses some of the same clock speeds as the 80386DX line and is priced competitively with it. However, a 486sx running at the same speed as a 386DX is faster because its internal design is more efficient. In fact, Intel Corp. tests show that a 486sx can work twice as fast on some tasks as a 386DX running at the same clock speed. And, whereas an 80386DX running at a faster clock speed could approach the performance of a 486sx at a lower cost, some tests have shown that a 25-Mhz 486sx can be up to 40-percent faster than a 33-Mhz 386DX.

Couple the speed issue with the fact that the 486 line is a newer technology and may offer easier and better upgrade potential, and Digital's 486sx-based PC is an excellent CPU choice for performance and price.

The Digital 425sx LP is a compact, low-profile computer with a lot of logic packed onto the mother board. You won't need an additional display adapter, for example, and the controllers and ports are all on the mother board. Consequently, there are only three available slots, which are turned sideways to keep the case slim.

The configuration of this machine is attractive. The low-profile box fits easily under the monitor on a desktop. Its rounded corners and uncluttered appearance make it look less like a high-tech PC and more like a terminal. The integral power supply fan is extremely quiet, thus the system easily fits into a crowded office environment.

CPU on daughter board

The machine's mother board is small (roughly 8.5 x 14 inches) and positioned in the left side of the case. The internal hard drive and floppy disks partially cover the right side of the mother board, which means one has to remove installed drives to upgrade system cache.

Similar to other members of the LP family (except the entry-level 386sx model), this machine uses a daughter-board arrangement to hold the CPU. The board attaches to the front of the mother board via a set of pin connecto and lies parallel to it. This flexible desig lets Digital use a common mother boa and other building blocks for the whc line, changing only the daughter boa to build models.

The daughter board in the LP li includes a separate 169-pin upgra socket. You can use this socket for math coprocessor on the 486sx model to install a faster 80486DX chip or clock doubler chip in any of t upgradeable machines. (*See story below.*)

Interestingly, the LP series does n include a SCSI or network interfac Rather, you have to plug in a separa SCSI adapter or a network interface in one of the available expansion slots. Th keeps the initial cost of the machine lo and makes it so that only those use who really need SCSI pay for it.

However, you would normally expe to find at least a network interface ar perhaps a SCSI port on a Digit machine.

System software is pre-installed; ther fore, you can plug in power, attach

Need To Upgrade? It's a Snap

All members of the LP family except the low-end 80386sx model, can be pumped up to faster, higher-performance machines. The 40-Mhz 80386DX unit, for example, can be moved to any of the 486 models simply by replacing the daughter card. Any of the 486 models can be upgraded easily by plugging a faster CPU in the vacancy socket. The speed of the 486 processors can be doubled using Intel's clock-doubling chip.

The DX2 chip doubles the internal processing speed of the onboard processor. A 16- or 20-Mhz system operates at 50 Mhz; a 33-Mhz system operates at 66 Mhz. The speed doubling takes place on internal calculations. Data is moved from the CPU to the rest of the system at the existing system speed.

The so-called "upgrade" socket is becoming a common feature with new PCs, and Digital's LP line is no exception. This 169-pin "overdrive" or "performance enhancement" socket (Digital calls it a "vacancy" socket) enables users to plug in an overdrive chip, which is essentially an enhanced 80486 microprocessor with DX2 clock-doubling circuitry.

The overdrive chip disables the existing CPU and takes over at a higher speed. The overdrive chip includes a math coprocessor as well as Intel's DX2 speed-doubling technology. This means it operates at twice the system clock speed internally, but still communicates with the rest of the system at the existing system speed.

Two overdrive chips are available, one to upgrade 16- or 20-Mhz systems and another to spark up 25-Mhz systems. The 25-Mhz version includes a heat sink to help dissipate the additional heat generated by high-speed CPU operation. The overdrive concept helps users upgrade their own systems. Since the existing CPU does not have to be removed, you can upgrade to a faster CPU by plugging a chip into the extra socket.

Adding a coprocessor

You can use the vacancy socket on Digital's LP machines in two other ways as well. If all you need is enhanced math performance, you can also plug in a math coprocessor in sx systems. (Remember, the sx chip's internal math coprocessor is disabled). And, you can plug in a higher-speed 80486DX CPU. In this case, the onboard CPU is disabled and the new upgrade processor takes over.

Remember that while the upgrade process lets you speed processing on your existing system, such an upgraded system will not run as fast as one designed from the ground up for 50- or 66-Mhz operation. The reason is obvious. When you plug a 50-Mhz chip into a 25-Mhz system, the computer's memory, BIOS and controllers still operate at the original system speed.

A full-blown 50- or 66-Mhz system, on the other hand, includes memory and other components rated at the speed of the processor. How much these considerations affect actual throughput depends on your applications, primarily, but you should be aware that there will be differences. At the same time, however, a 50-Mhz chip in a 25-Mhz system should provide noticeable performance improvements, especially when your applications are compute-intensive as opposed to I/O-intensive.

The CPU daughter board on the LP machines includes additional sockets for expansion. The base unit comes with 128 KBytes of external, adaptive write-back secondary cache. You can plug in an additional 128 KBytes of cache for even more speed. – *T.B.*

onitor, keyboard and mouse, and be) and running in a few minutes. censed copies of MS-DOS 5.0, licrosoft Windows 3.1 and other utilities e included with the package, but you on't have to install them unless you hange drives or crash some software.

In keeping with Digital's ongoing push r broader markets, the LP series will be fered through some conventional PC itlets, including national distributors id perhaps even mail order. Digital's esktop Direct sales organization will arket the machines (1-800-PC-BY-EC), and they can be ordered through her Digital sources. But look for the EC name to appear in places it hasn't fore, too. As this was written, no one at igital would say which sales organiza-ons may carry the machines.

Digital designed the LP series for easy grades to higher performance. You n plug in a faster CPU daughter card or uble the clock speed with one of Intel orp.'s clock doubler chips. An interest-g aspect of the Digital design is iboard clock-speed jumpers. All of the rmal clocks are built into the mother ard, so, for example, to upgrade a 25-hz system to a 33-Mhz system, you n change the jumper, plug in a new PU, upgrade memory (if necessary), d you're up and running with a faster achine.

The machine is supplied with a quick-art guide, a fairly detailed user manual, parate instructions on upgrading the PU and memory, as well as software cumentation. Overall, the DEC docu-entation is better than many competi-e products we've seen. Detailed draw-gs and charts help you locate jumpers, ckets and switches. You'll have to get pport telephone numbers when you y the machine, however, because no formation on this is included with the ckage we evaluated. And, there is no chnical reference manual with the sys-m, nor is one available from Digital.

summary

The overall impression this newest igital PC makes is good. The package is tractive and performance is excellent. d, Digital's worldwide sales, shipping d maintenance organization makes ese PCs attractive to multinational rporations that want system compati-lity and single-source supply. The ECpc 486sx LP we evaluated is a good rformer, appears to have quality con-uction and is competitively priced. ■

Tom Badgett is a principal of Word Associa-n Inc. and the author of several books on C computing.

Chip Design Speeds Microsoft Windows

Among the features Digital Equipment Corp. is pushing for the LP line is improved performance with Microsoft Windows – at least four times faster, according to the company. Actually, your own experience with Windows could be even better, depending on the applications you run.

How do they do it? It's all in the chips. The LP mother board includes VGA (Video Graphic Array)-compatible video circuitry based on the S3 Inc. 86C924 graphics accelerator. This chip was designed from the ground up to improve the performance of Microsoft Windows. This is done in two ways.

First, the chip includes eight of the most common Windows commands and procedures – such as moving boxes and redrawing the screen. A separate software driver captures these commands when they are issued and, instead of sending the commands to system memory for processing by the main CPU, they are sent to the accelerator chip. There, the procedures are processed directly in hardware and the results sent to the screen without passing through conventional system RAM and without the main CPU stopping what it was doing to process these video messages.

Systems without the accelerator have to pass video data back and forth across the 8-Mhz I/O bus, in and out of memory. With the 86C924, that step is skipped for most operations, speeding Windows considerably. And, although Digital suggests an improvement of four times, experts at S3, which built the chip, say you can expect eight-times-or better performance with some software. WordPerfect for Windows, for example, is notoriously slow in screen scrolling. S3 said to expect 10 to 20 times better scrolling in WordPerfect with the Digital LP video technology.

Our tests confirmed this claim. Large documents with WordPerfect for Windows are all but unmanageable with the standard system we used, a 33-Mhz 80386DX machine with 8 MBytes of system RAM and a 1-MByte SVGA board running at 1,024- x 768-pixel resolution. WordPerfect on the DECpc 425sx LP, on the other hand, scrolls rapidly, even updating text boxes and image files integrated within a document in real time without the familiar (and frustrating) wait for screen updates.

One design feature improves performance in the Digital machines over conventional competitive models: the use of VRAM in the video circuitry. VRAM is dual-ported memory that lets the system update the screen and pull in new video data at the same time. Conventional dynamic RAM-based systems handle only one operation at a time: write the screen or gather new data for display.

Cost is negligible

And, while it is true that the graphics accelerator and VRAM technologies cost more than conventional SVGA adapters, the actual retail cost differential is less than $200 for add-on options. When incorporated with Digital's machines, the additional cost is probably negligible.

When the most common Windows functions are executed, the I/O bus is bypassed and performance is improved. What about the other calls, and what about when you load an image from disk, which requires CPU and main memory interaction? The Digital technology speeds these operations by using the local bus instead of the I/O bus. The local bus is a direct connection between the CPU and the video card that transfers data at system speed rather than the lower, 8-Mhz I/O bus speed. On a 33-Mhz system, this communication takes place at 33 Mhz, for example.

This is a feature you cannot easily add to existing systems, but when incorporated into a new mother board, it is a sensible and cost-effective addition. – *T.B.*

Speaking with James Liu

James J. Liu, vice president of Digital Equipment Corp.'s Personal Computer Business Unit in Acton, Mass., was named to succeed John Rose as head of the Personal Computer Business Unit in July.

Digital is coming into a crowded market saying it can compete by producing its own PCs. What makes you think you can pull it off?

"We started out looking not only at quality but also at reducing the cost throughout the whole operation. We broke the cost structure down into a manifest – design/engineering through manufacturing, warehousing, distribution, promotion.

"The PC business is a high-volume business. It is very important that you look at inventory, pipeline and obsolescence of technology costs. These are three very important areas of expenses. What we did in design/engineering was [to turn] the design into a modular approach so that you can turn the design into a new product by replacing only a tiny portion of the CPU daughter card. You do not have to redesign the whole thing. You do not have to scrap the whole thing.

"We have the same boxes for the whole product line. The power supplies are the same. The floppies and hard disks are all the same. So upgradeability from the current model requires a minor change of the daughter card.

"We also have a vacancy socket into which you can plug in an [Intel Corp.] clock doubler chip to double the frequency from 33 Mhz to 66 Mhz. The daughter card and vacancy socket are double protection for our customers, which is unique in the industry.

"We also use advanced S3 video chips [S3 Inc. 86C924 microprocessors], which give you the best video performance, because now the chips interface directly from the CPU to the local bus – at a bandwidth three or four times that of the EISA [Extended Industry Standard Architecture] bus. You take advantage of very fast CPU performance in terms of the video display. We bring the power of the CPU to the customer – that's our added value. If you go through the EISA bus, you have a limitation on how much you can do. Even if you have a fast CPU, it doesn't help you much if your video is slow.

"The other thing we do is use a quiet fan, with variable speed. It makes the office a much quieter place to work."

If your PCs have these differentiators, how are you going to produce them at competitive prices?

We did everything we could to reduce the costs of producing these PCs. We ship all the components to the market for final assembly.

"We did everything we could to reduce the costs of pr ducing these PCs.

"We call it the franchise model. We ship all the comp nents – the CPU, the mother board, the disk, the floppies to the market for final assembly. We bring them from wha ever geography makes sense to supply a particular comp nent.

"It's very much like a McDonald's restaurant. You b the beef, the napkins, the tablecloth and ship them to t restaurant, where they control the qua ity. You bring the final assembly poi closer to the customer and that w guarantee the quality when you deliv the product. It's very much the same delivering a hamburger or cheeseburg

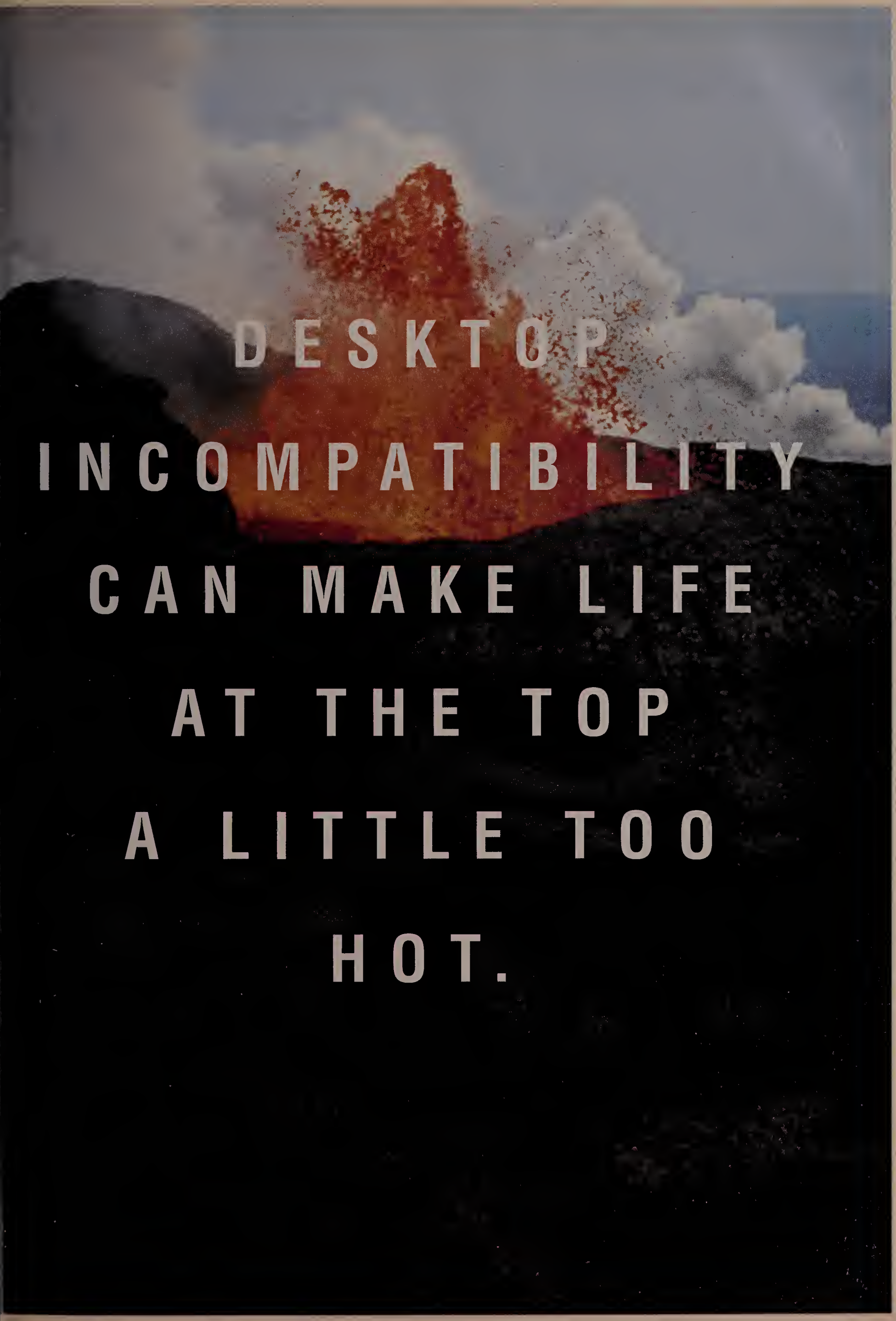
"My inventory can be minimal. I c stock all common components. T only thing that is different is the daug ter card. We also reduce the cost freight and duty because now you sh them by subassembly. [*Lower duties a paid on imported parts than on fully assembl products. – Ed.*]

"The CPU daughter card is an expe sive, small item that I can ship them b air and reduce the pipeline time fro 21 days to only five days. My invento cost will be less. Bulky components, th monitor, the box, etc., can be shippe by sea. Those components chang more slowly, so that fits my model ve well. In the PC business, inventory is very important part of your business. PC can become obsolete very quickl When the technology changes, we ca change very fast.

"We've tried to learn from wh McDonald's did in the restaurant bus ness. It's very similar. We developed cookbook for each country for fin assembly, so the product will be consis tent. We're the only company that ca do that."

Don't you still have a cost confli between low-priced PCs and doin all the things that Digital wants t do in producing computers?

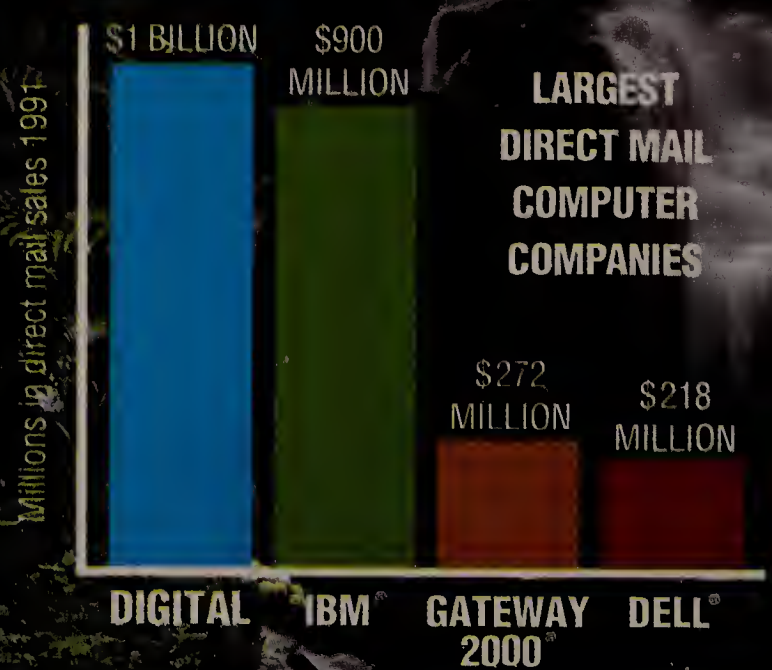
"Quality doesn't mean higher costs. Quality means mor knowledge and skills. For example, when you pass a moth er board through the soldering process, the control of th temperature determines the quality of the soldering. A young company does not have 35 years of manufacturin experience to control the temperature flow. That doesn cost you money. It costs you knowledge and skills, an that's how we can build a quality product without incur ring more costs." ■


DESKTOP
INCOMPATIBILITY
CAN MAKE LIFE
AT THE TOP
A LITTLE TOO
HOT.

MAYBE THAT'S WHY SO MANY PEOPLE WANT DIGITAL ON THEIR DESKTOP.

"Digital Equipment Corporation racked up $1 billion in catalog revenue last year, toppling Dell Computer as the computer industry's top mail-order seller."

— *USA Today*, August 7, 1992



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f"Network Certified by Digital." More than a seal of approval. It's a statement of fact. Pure and simple. It's what separates Digital from the crowd.

Even today, when most companies are building products that can connect, Digital builds to a higher standard: *Integration*. The only standard that saves *you* from unhappy users and lost time and money when your LAN goes down.

In these headline making days of PC company cost-cutting maneuvers and substandard components, only Digital continues to have the technology, alliances and commitment to guarantee integration in today's complex multi-vendor environments — and tomorrow's.

Some people tell us we're too obsessed with integration. Too much the engineers. So be it. At Digital we still believe in taking the heat — so you'll never have to.

"...Digital had the combination of engineering expertise, experience in systems integration, and worldwide quality control standards that we were looking for. Equally important was the assurance Digital could give us on maintenance. We can't risk anything going wrong in the middle of a trading session."

— Richard Heckinger, Hong Kong Stock Exchange

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• 3.5" 1.44MB Floppy Drive
• Keyboard and Mouse
• MS-DOS 5.0 & Windows 3.1
$1,549

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"DECPC BESTS LOW-COST 486DX FIELD. PERFORMANCE, EXPANDABILITY AND DESIGN STAND OUT...Digital Equipment Corp.'s system was the overall winner in PC Week Labs tests..." — *PC Week*, October 5, 1992

PC WEEK LABS

Scoreboard

Based on a scale of 1-5 (5=excellent).		Advanced Logic Research Inc. *Flyer 32DT 4DX/33*	AST Research Inc. *Bravo 4/33 Model 123B*	Dell Computer Corp. *Dimension 486DX/33*	Digital Equipment Corp. *DECpc 433dx LP*	IBM PC Co. *PS/1 Model 2155-S76*	Zenith Data Systems *Z-433DX Model 200*
Overall weighted score		3.6	3.5	2.4	4.0	2.8	3.4
1. Price vs. performance	(30%)	4	4	2	4	3	4
2. Performance	(25%)	3	4	2	4	3	3
3. Expandability	(25%)	4	3	3	4	2	3
4. Serviceability	(10%)	3	3	2	4	3	4
5. Quality of construction	(10%)	3	2	3	4	3	3

1. Overall performance relative to cost (comparative among these six machines). 2. Overall comparative system performance in all tests. 3. Support for processor, memory, storage and expansion board upgrades. 4. Ease of processor, memory, storage and expansion board upgrades. 5. How well the system is assembled (including case design, power supply and tools required for assembly).

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"I think they're a winner."

— Andrew Seybold, Editor-in-Chief
The Outlook on Professional Computing
August 24, 1992

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"Ben & Jerry's networks its PCs via DEC PATHWORKS... We're happy with our architecture. It meets our current needs and can expand to meet future ones."

— *LAN Magazine*, March 1992

NEW!

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DECdirect™

Supporting It All

Digital offers one-stop service to deal with complexities of multivendor PC sites

A recent full-page cartoon in a national magazine showed two lab-coated MIS professionals scratching their heads, struggling to figure ıt what went wrong with their network of multivendor PCs. Two comıter screens in the foreground are led with arrows, each pointing at the her as if to say, "He did it!"

Finding the source of a problem across multivendor PC installation often crees a problem as large as the one the etwork manager was hoping to solve. he complex mix of hardware, software ıd networking technologies, as well as vendors, OEMs and service roviders, can prolong downtime and ave a network manager confused. In uations like this, customers want a ide range of services and a single point contact for problems that cut across atforms, vendors and technologies.

Paul Kelly, corporate business manager r desktop services at Digital Equipent Corp. in Stow, Mass., believes igital can provide the one-stop-shopng service.

"What clients really want from a serce provider is a company that has good chnical skills in its own right, as well as ıntractual relationships with other

s PC support manager at Boston's ildren's Hospital, Kevin Hourican ıs his hands full. The hospital has ore than 1,500 pieces of comput-g equipment under contract with gital. "I really like Digital's ability to ıpport everything," says Hourican.

Copyright 1992 by Seth Resnick

major vendors through which it can track down and solve multivendor problems," Kelly said.

Digital is no stranger to the PC market, having provided PC integration services for more than 10 years. It is currently one of the fastest growing PC vendors in the industry, according to Computer Intelligence, a La Jolla, Calif.-based market research firm, and its PC Integration Services business has been growing at double-digit rates over the last two fiscal years.

At the same time, Digital has contractual relationships with many of the industry's largest PC software vendors, including Microsoft Corp., Banyan Systems Inc. and Novell Inc.

"If we look at the contract mix at most end-user sites, in terms of multivendor support, it becomes obvious that we have moved out of being a per-box supporter," Kelly said. "Any fault within the system is really a fault with the entire system and not an isolated problem."

Kelly said Digital has invested nearly $30 million in multivendor testing and certification through its Customer Support Centers. For example, many of the centers maintain a wide mix of PC hardware, software and networking equipment so that when a user calls with a problem, Digital technicians certified for each of the different packages can simulate the user's network environment onsite in order to better diagnose the problem.

Nina Lytton, president of Open Systems Advisors Inc. in Boston, Mass., said she was essentially "pre-sold" on Digital's phone support for multivendor PC environments based in part on its ability to simulate her 10-node LAN environment at its Customer Support Centers.

LAN Manager network

Open Systems Advisors has a mixed LAN Manager network of IBM-compatible PCs, including those from Dell Computer Corp., Compaq Computer Corp., Hewlett-Packard Co. and IBM. (Open Systems Advisers has no Digital PCs.) The server on the network is a System Pro running OS/2, while the clients are IBM-compatible PCs running Microsoft Windows 3.1. The primary application on the network is an R-Base database with more than 15,000 names that serves as a single source for the entire company. The database is a mission-critical application for Open Systems Advisors – no database means no business.

"What we were really looking for was a single number we could call if we had any problems," Lytton said. "Digital has lots of its own experts who brainstorm among themselves and figure out the problems that are too complex for a small business like us to handle."

For example, the employees at Open Systems Advisors recently went into work only to find they had lost access to R-Base as a result of some unknown problem. The only thing the network manager knew was that the cover was off the server and a cleaning person had been in the office the night before. Open Systems Advisors called Digital's phone support and soon had a conference call involving three experts – one specializing in R-Base, one in OS/2 and one in LAN Manager.

By the end of the day, the team of experts determined that Open Systems Advisors would be best served by having the database restored from tape and had the company up and running by the next morning. In this case, the Digital experts saved the client from chasing leads that would prove unfruitful and held network downtime to a minimum.

"We used to get our support from different dealers, but we ran into knowledge and timeliness problems," Lytton said. "The database support people would say it was the network [vendor], which would blame it on the hardwa etc. Digital gives us a single point of co tact."

Digital has its own experts who brainstorm among themselves and figure out the problems that are too complex for a small business like us to handle.

Nina Lytton
OPEN SYSTEMS ADVISORS

Much larger installations also fi Digital's offer enticing. Boston's Ch dren's Hospital has more than 1,5 pieces of computing equipment (PC printers and peripherals) under contra with Digital, including 700 IBM PC 100 clones and more than 200 App Computer Inc. Macintoshes. Most the PCs are used as stand-alone boxe while 120 are networked using Digita Pathworks. Another 15 reside on a No ell NetWare network.

"The largest part of our service co tract with Digital is for hardware suppo on our PCs, printers and peripherals said Kevin Hourica PC support manag at Children's Hosp tal. In addition, t hospital purchase applications and ne work support fro Digital.

Prior to choosir Digital for its suppo needs, Children Hospital contracte with IBM to cover i hardware, while Sea maintained the mix Hewlett-Packard an Epson printers, an the hospital did i own application su port. As the numb of users grew, Chi dren's Hospital foun it could not keep up with the applicatio support without outside help. At th same time, it found that there were limi to the support being provided by IB and Sears – IBM would not support th clone PCs, and Sears could not deal wit the complex interaction of printers, ne works and PCs.

"The best thing we found about Digita besides being a single point of contac was that they were very, very flexible an willing to customize their service, Hourican said. For example, Digital wa willing to come to the site and insta applications for end users and eve helped to physically move equipment. A one point, an end user had a severe har disk crash and Digital personnel went t the site, removed the hard disk, sent it t the manufacturer and reinstalled it.

"I really like Digital's ability to suppor everything," Hourican said. "That wa we could give our end users a singl phone number and leave it up to Digita to triage and fix the problems." ■

Manufactured by DEC

Digital Equipment Corp. is capitalizing on its strengths as a worldwide manufacturing company in an attempt become a leader in industry-stan-d, modular PCs that can be graded to a new CPU with a snap-card.

n order to compete with smaller, et-footed companies, Digital has opted a "franchise" manufacturing l distribution model that will ow PCs to be assembled and pped from seven integration cen-s, while ensuring that the output each center matches the quality of other assembly point.

When buying a PC, customers ask mselves, will this company be e to support me? Will it support in multiple countries? Is the sup-rt and service consistent? Our siness architecture and strategies dress these concerns," said James Liu, gital's new vice president of its Per-nal Computer Business Unit.

Under Liu's aegis, Digital recently set out manufacturing its own DECpc LP ow Profile) line, which consists of six odels. The systems, priced from $899 $2,199, range from a 33-Mhz, 386-sed system to a high-end 66-Mhz, 6dx2-based system.

The new PCs are based on a modular sign with components manufactured the company's facility in Taiwan for embly at seven centers around the orld – Springfield, Mass.; Kanata, ntario; Tokyo, Japan; Taoyuan, Tai-n; Sydney, Australia; Sao Paulo, azil; and Ayr, Scotland. Previously, gital had subcontracted PC manufac-ring to Tandy Corp., Intel Corp. and g. C . Olivetti & Co.

'A lot of DEC customers were jumping ip. DEC will be able to pull those cus-mers back into the fold because of the machines' specs and pricing. If DEC able to get existing customers excited out this line, we think they'll do $200 illion in sales in 1992 and 1993," said ndal Guisto, senior analyst at Work-oup Technologies, a market research m in Hampton, N.H. Digital officials timate 1992 to 1993 PC revenues in $250 million range.

nfoCorp., a market research firm in Santa Clara, Calif., reports that DEC sold 134,700 PCs through the first half of 1992, compared to 69,660 in all of 1991.

The new PCs, including the high-end 66-Mhz 486dx2, are based on a modular design with components manufactured at the firm's Taiwan facility for assembly at seven centers worldwide.

The new PC's modular design allows it to be customized by snapping in different components, 80 percent of which are common to all models. "This cuts down on inventory and price. We also cut costs by shipping the heavy components by ship and the lighter, high-value components such as mother boards and daughter boards by air," said Liu.

Digital is aiming to shave a few hundred dollars off the cost of making each PC it sells, he explained.

The franchise model

Digital unveiled its franchise model with each manufacturing center following the same rules as it launched the LP line of PCs at the end of August.

"Large customers get the same models everywhere. These customers save on testing and training because application software works everywhere, network compatibility applies everywhere and upgrades are available everywhere," said Liu. Digital is one of the few companies large enough to build and sell PCs on an international franchise model, he claimed. The franchise model allows faster sales, service and support by providing centers closer to customers. The approach offers the strengths of both large and small vendors, Liu added.

"This strategy looks more sustainable than the OEMing strategy they pursued earlier. Bob Palmer [Digital's new president] had said, to make money in PCs, you have to build them yourself," said Eric Clow, senior analyst at InfoCorp.

When Intel, Olivetti and Tandy were producing its PCs, Digital's marketing had been the strongest part of its PC strategy. "Now it is adding design and manufacturing. The missing manufacturing piece was a weakness," Clow noted.

"Overall, DEC will have to make up in volume for the lower prices it is offering," said Workgroup Technologies' Guisto. "DEC squeezes $100 to $200 out of each LP box and is hoping that will offset some of the volume they need. I don't think it will as much as they expect because DEC's new strategy will energize the competition."

The new LPs will be sold through Digital's Desktop Direct for PCs program. Launched last January, Desktop Direct allowed the company to tap into the $27 billion PC market by establishing a direct channel for customers that combines 50 percent off Digital list prices, fast response, and full-line service and support. It has its own toll-free number (1-800-PC-BY-DEC), sales and marketing force, and catalog. Customers are promised 48-hour turnaround, optional next-day delivery, 100-percent qualified parts, a 30-day money-back guarantee and one year of free onsite service.

"DEC's PC business is growing fast, but they started at a real low base – so it doesn't take much to pump those numbers up. DEC's trying to attract the corporate user with the combination of reliability, service and support, which are positives for this sort of a buyer," said Steve Widen, senior analyst at Workgroup Technologies.

"But," he asked, "are they a little too late in the PC market to be able to garner a significant amount of market share?"

"DEC has a bigger presence in Fortune 100 accounts than the other PC vendors and everyone at these accounts knows DEC's reputation for service and support. DEC is in a good position to differentiate itself," said Guisto. ■

Speaking with Vijay Thakur

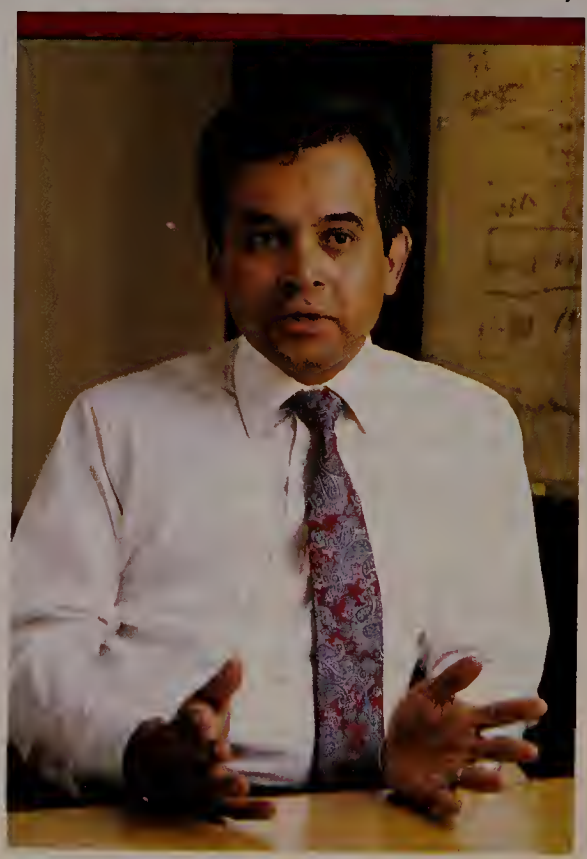
Vijay Thakur, director of the PC Integration Business Unit of Digital Equipment Corp. in Littleton, Mass., is the head of the Pathworks product line.

What is the future direction of your PC connectivity software?

"We want to do three things with Pathworks. We clearly want to use the Windows paradigm and make the entire installation management, configuration and operation intuitive. Installing something like this under VMS today requires you to have VMS knowledge and PC knowledge. That combination is scarce in the market and it's not going to get any better. So what we have to do is create a Windows-driven environment with a graphical, mouse-driven interface so you can pick-and-choose, click, and drag and draw, rather than know the VMS syntax. That's a priority. We want to drive to the point where the management environment is very intuitive and Windows-driven. The first phase will happen in early 1993.

"The second thing we want to do is create a single, integrated server environment for the three popular technologies, NetWare, LAN Manager and Macintosh. Right now you have three separate server environments. You can run them all on the same server at the same time, but they look like three different server environments. The Macintosh looks like a Macintosh because our original goal was to make the server environment look native to the client. That satisfies today's market. But tomorrow's market ... wants some consistent environment from which to manage that heterogeneous environment.

"At the same time they want NetWare clients, LAN Manager clients and Mac clients to access the same information simultaneously in a shared, record-lock manner. So our second objective with the next version of Pathworks would be to create a single, integrated server environment. You can buy any Pathworks client of your choice, but you need only one set of bits on the server. Depending on the client that you have chosen, the appropriate server would be installed and the management environment would b consistent, Windows-driven, one."



Webb Chappell

We're building an integration environment on top of LAN Manager, NetWare and AppleShare for Macintosh. We're not tied to any one specific technology any more.

You frequently mention "information integ tion." How are you moving toward that?

"It is necessary for us to create that robust underlyi environment to allow the layer application services to be available people transparently. We intend add more value into Pathwor which we believe will be a necess prerequisite for all future informati integration services.

"For example, system manageme of heterogeneous clients and serve Or back-up services from any clie to any server. Or basic database acc engine API [application progra ming interface]. Virtually every app cation from now on is going require a database. Even a syste management application requires database — you're going to track these things and keep the informati in a database. So you're going to ha one common database engine a then that engine allows you to acce any of the back-end databases whether it is Informix or Sybase Ingres or Oracle or Rdb from Digi or DB2 from IBM, or whatever Pathworks will provide you with path to any of them. We believe t next generation of Pathworks shou have a database bundled into it. If y want access to any one of these dat bases, you would have it."

Doesn't that start to change th role that Pathworks plays? Instea of connecting PC users to the n and leaving them there, you' attempting to bring the deskto user much closer to the data?

"That's right. Pathworks is taking o the role of accommodating these pop ular technologies that become sta dard in the industry. We're actually building an integratio environment on top of LAN Manager, NetWare an AppleShare for Macintosh. That's an advantage that w have because we're not tied to any one specific technolo gy any more. We're trying to build an integration envi ronment around the heterogeneity of technology th people are going to have." ■

Pathworks Extends Its Reach

n its five years of existence, Digital Equipment Corp.'s Pathworks has grown from a link between the humble PC and the host VAX into a client-server infrastructure, sup-rting a variety of key platforms, GUIs aphical user interfaces) and network otocols.

oday Pathworks supports OS/2, Win-ws, the Apple Computer Inc. Macin-h and Unix along with the standard S-DOS PC. Microsoft Corp.'s LAN nager is part of Pathworks, which in n interoperates with Apple's Apple-are and offers partial integration with reigning local area network operating tem, Novell Inc.'s NetWare. Path-rks supports Ethernet and DECnet, might be expected of a Digital oduct, as well as TCP/IP, the X ndow System and X.400 mes-ing. With support provided by oteon Inc., Pathworks also rks with token ring.

hese capabilities are proving ractive to a growing number of nagers who need a client-server hitecture to link disparate plat-ms and environments that now aracterize many computing vironments. In the slow-to-w minicomputer industry, thworks has become a star. With million installed clients and a owth rate of 30 percent last year, thworks revenues are second ly to the VMS operating system elf in DEC's software business. Within foreseeable future, Pathworks rev-ues will overtake VMS, said Vijay akur, group manager of Digital's PC tegration Business Unit in Littleton, ass.

Digital officials have plans for Path-orks that they believe will continue to hance its appeal. Thakur sees the evo-tion of Pathworks as going through ree stages. The first stage consisted of e use of LAN Manager to link MS-OS and Windows PCs to the VAX. e second stage had Pathworks reaching t to a broader array of platforms, envi-nments and protocols.

Thakur conceives of the third stage as nformation integration." Pathworks is w moving beyond the limited capacity supply connectivity and file and print rvices to a variety of desktop devices o a more fully functional, heteroge-ous environment.

Such an environment would offer the ability to access a document throughout the network, regardless of platform, environment or protocol. It could share voice, image and other multimedia services across desktop devices, offer enterprise-wide messaging and transaction processing and a host of other features.

These functions – or some of them – indicate the future direction of Pathworks. In the short term, over the next six months, users can expect a series of announcements that extend Pathworks to new platforms while increasing the range of features and ease of managing the PC integration suite, Thakur said.

When Microsoft's Windows NT ships, DEC will support it within Pathworks on both the client and the server side. Thakur said such support could be expected within the next six months. The Santa Cruz Organization Inc.'s SCO Unix may be supported in the same time frame if users request it, said Katrina Hollman, marketing manager for the PC integration group.

Pathworks developers are working on a new management application that will enable a user of a Windows or Windows NT Pathworks client to manage the entire Pathworks network. Today Pathworks can only be managed from the server and the task requires a high degree of skill. Hollman said Digital plans to regularize management of all the environments so that a standard GUI becomes the interface to all current and future Pathworks-supported platforms and protocols.

"You will see Novell doing a great job managing NetWare and Microsoft doing a great job managing NT," Thakur said. "But Pathworks is going to be perhaps the only technology out there doing an equally good job producing a GUI-driven management environment across all these technologies and platforms."

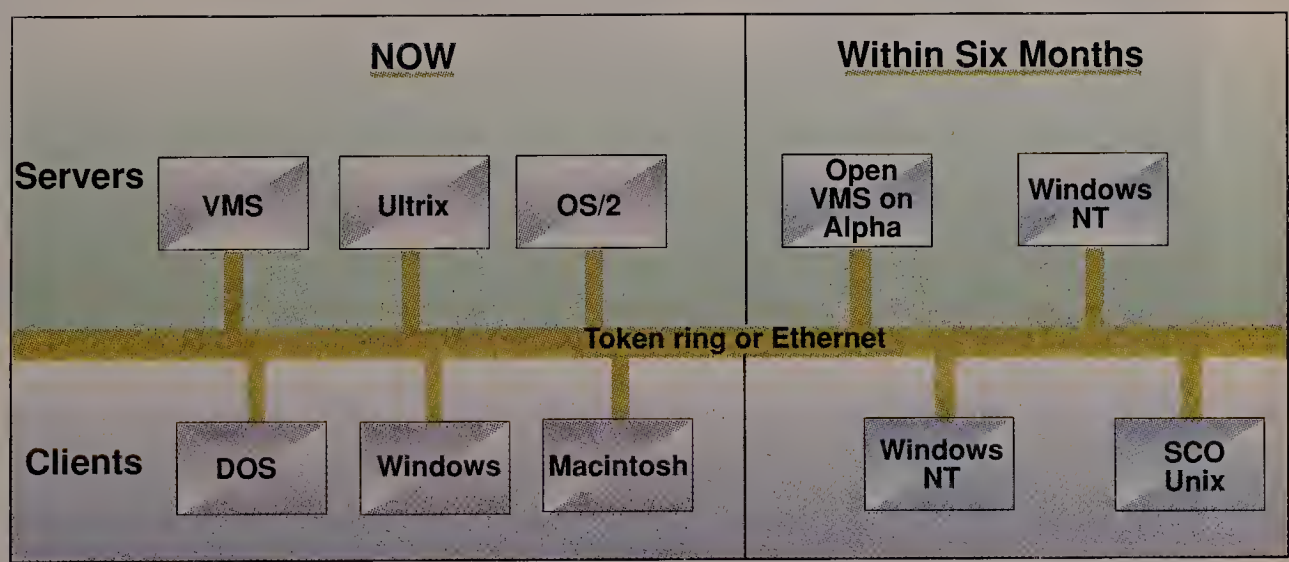
By late spring Digital intends to offer NetWare file and print services from either VMS or Ultrix Pathworks servers. Today Pathworks clients running the NetWare Coexistence option can select either a Pathworks or NetWare server. But they cannot obtain NetWare services from the Pathworks server.

Thakur said this move would be one step toward the goal of providing "a single integrated server environment." Today Pathworks servers are separate. Pathworks for Macintosh, for example, provides file service to Macs, and Pathworks for DOS provides file services for DOS or Windows systems. Both server applications can run on the same VMS system. And while both save files in a VMS format, both provide interfaces to the client user that make it appear as if files are in their native formats.

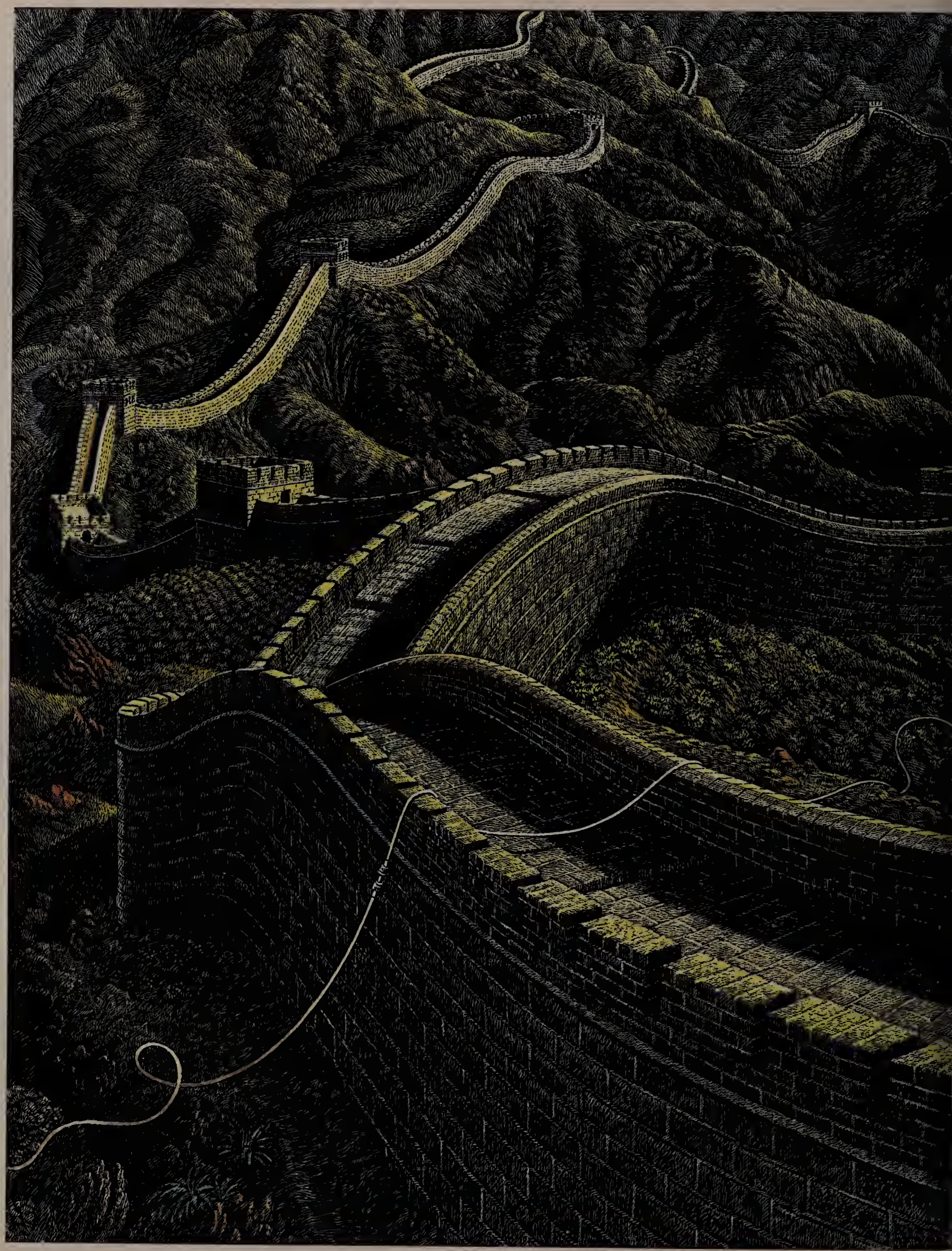
"But if a Mac client using AppleShare and a DOS client using LAN Manager in a Pathworks environment want to access the same file today, they can only do it as a sequential access. They could not do a simultaneous read-write because we lack the necessary record locking and management," Thakur said. "In the longer term, our vision is to combine the ways of accessing the server into an integrated server environment."

For users turning to an open systems philosophy to avoid dependence on single vendors, Pathworks supports an array of standards and de facto standards. But there are still holes. Digital says, for

Continued on page 26



Digital views PathWorks' next major phase as moving beyond integrating platforms, environments and protocols to "information integration."



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Mainframe on The Desktop

"You can run a whole company from one of these machines," says DEC's Gaubatz. The 64-bit Alpha workstations are due by year's end.

DEC's high-end Alpha workstation, code-named Flamingo, is a single-process machine that features six 100-Mbit/sec. TurboChannel slots.

Digital Equipment Corp. recently offered a sneak preview of its upcoming Alpha workstations, code-named Sandpiper and Flamingo, featuring three and six 100-Mbit/sec. TurboChannel slots, respectively. Digital touts the high-end Flamingo as a "desktop mainframe."

Flamingo will likely be priced at less than $50,000, and Sandpiper, the midrange model, will likely be less than $20,000. Both are single-processor machines and will be part of a complete line of Alpha workstations to be announced by the end of the year.

"Flamingo is the highest end traditional workstation we're addressing right now. I would position the Sandpiper in the midrange. That leaves room for other things to happen at the low end," said Don Gaubatz, vice president of Digital's Workstations and Servers Group in Maynard, Mass.

"We do have low-end machines actually running at this time on at least two operating systems. You're looking at what I call a full product line very early in the launch of the Alpha workstation family," said Gaubatz.

The Alpha workstations are a continuation of the existing DECstation line, according to Gaubatz. Common to both lines is the TurboChannel system bus. The machines also have the same two-dimensional and three-dimensional graphics, multimedia, communications, storage, and VME and real-time interfaces. The primary difference between the DECstations and the Alpha workstations is the 64-bit CPU.

"People tend to overlook the fact that going from a 32-bit machine to a 64-bit machine is a major accomplishment. You can run a machine at 32 bits a achieve reasonable SPECmarks," sa Gaubatz. "To get the same SPECmar while you're actually running a machi twice as big [64 bits] says you have unprecedented amount of 'headroon These platforms will have the headroo to be able to evolve large applicatio through the 1990s."

An example of a large application ECAD (electrical computer-aid design) used in microprocessor eng neering. Chip design can be done on 32-bit system, but it becomes increasin ly more difficult because you run out headroom and start bumping yo elbows against the sides of the box, sa Gaubatz. From the chip designer's pe spective, the actual microprocessor is, i some cases, as much a reflection of th design environment as of the physic entity, he said.

Other "large" applications include CAD (mechanical computer-aided sign). For example, the Flamingo uld produce an image of an engine ock and a piston and enable users to fit piston into the cylinder block, check- clearances. The approach allows the signer to model how the pieces will ork together and adjust the clearances ring the design stage, rather than in ly manufacturing.

The systems promise a much higher el of simulation using more complex a sets and more data, Gaubatz added.

pplications are in demand

n architectural applications, the chines provide the capability to show a ospective buyer of a 90-story building w it will look inside and out, exactly as would be when occupied. "This is one those situations where the least phisticated customer or user will place largest demands on the system. Such plications are in demand as soon as y are implementable," Gaubatz said.

Applications such as these put existing mputer systems at their limits. "When say to the industry we're going to 64 s and some people say we don't need it hat's not true. These systems not only ve the power to do these kinds of plications, but also the room to grow yond them," said Gaubatz.

Currently, Digital is working on run- ng benchmarks for the Flamingo and ndpiper, which the company says are powerful that they have the ability to ntribute as database servers and appli- ion servers. "We've doubled the word e and the capacity. For those applica- ns in which the data spills over and comes twice as big, the systems are not ing to slow down. That's what we ean by headroom. The Flamingo is lit- lly a desktop mainframe. This chine is more computing than most mpanies have in their whole place. u can run a whole company from one these machines," said Gaubatz.

The Alpha CPU itself features 8 Bytes of internal cache for data and 8 Bytes for instructions. Secondary cache nsists of 512 KBytes with a high- eed, 256-KByte data bus tying the sec- dary cache to main memory. "We ve doubled the [word] width for the ch. We can fetch 32 bytes in one cycle, 256 bits comes flying into cache in out 200 nanoseconds. The memory d cache have been optimized for the pha chip," said Bill Jackson, marketing nager for Alpha workstations in May- rd, Mass.

The 100-Mbit/sec. TurboChannel slots

Snap-in CPU Upgrades Keep DECstation Family Current

Although Alpha chips are at the heart of still-to-be-announced DEC workstations, the company has not forgotten the microprocessor architecture that powered its earlier entrants into the RISC market.

Customers who invested in Ultrix-based DECstations that use the MIPS R3000 family of chips will soon be able to move to the next generation of MIPS processors by simply snapping new "daughter cards" onto the mother boards of their workstations.

DECstation Product Manager Tracy Richardson emphasized the ease of these customer-installable upgrades to the R4000 chip, which he said will deliver a performance increase doubling or tripling the power of Digital's current R3000A-based workstations.

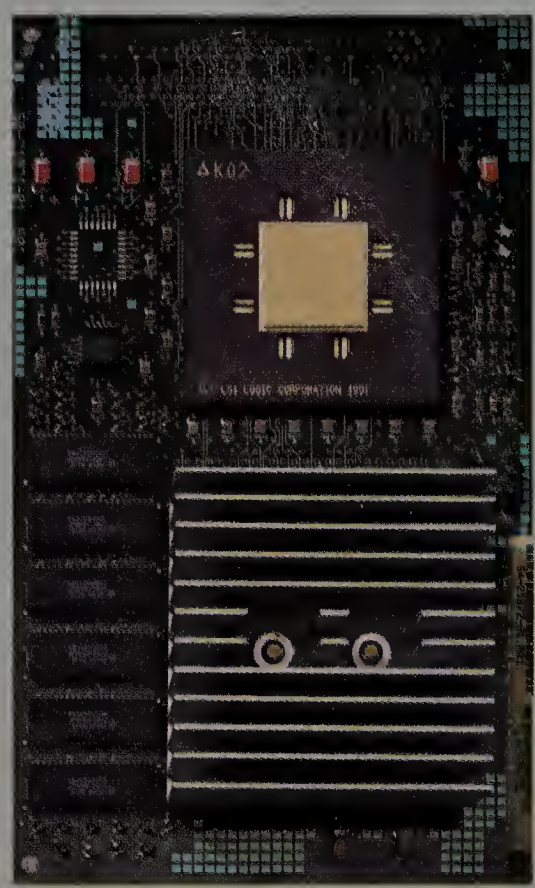
In addition to installing the new daughter card, users will also have to install a revision of Ultrix that supports the R4000 chip, said Richardson.

The R4000 is a 64-bit chip, but the Digital implementation will be 32 bits. Digital plans to use the fastest chips available in volume on the daughter cards, according to Richardson. The first available upgrades will use an R4000 running at 50 Mhz.

Even in a 32-bit implementation, the R4000 contains design features that take it beyond the R3000 in performance. Industry chip guru Michael Slater wrote in his October 1991 "Microprocessor Report Newsletter" that the superpipelined R4000 is "the first of a new generation of microprocessors that will reshape computer systems over the next few years."

Slater said that although the R4000's average of 2 to 2.5 clocks/instruction is roughly twice that of the R3000's 1.25 clocks/instruction, the performance gain comes from the fact that the deeper pipeline makes a higher clock rate possible. According to Slater, the R4000 appears from an external view to fetch, decode, dispatch and execute two instructions per cycle at 50 Mhz, but when viewed internally, it is apparent that the processor runs at 100 Mhz with a pipeline executing one instruction per cycle.

Slater added that although the R3000 peaked at 40 Mhz, the R4000 is starting out with a pipeline clock of 100 Mhz.



The MIPS R4000 64-bit chip is designed to serve as the basis for two and possibly three generations of processors.

He said the R4000 is designed to serve as the basis for two and possibly three generations of processors: One next-generation version will feature a smaller die size and lower power dissipation, and another will have twice as much cache, 32 KBytes, and will be designed to operate at 150 Mhz internally. Another version in 1993 will have a 64-KByte cache using 0.5-micron and denser processes, and operate at a 200-Mhz internal clock rate.

DEC's Richardson said the upgrades will be offered for all current DECstations: the Personal DECstation 5000 Models 20, 25, and 33 and the DECstation 5000 Models 133 and 240. Two form factors for the daughter cards exist. One measuring 3 x 5 inches will be used in all of the models except the 240, which will require a 5- x 8-inch daughter card. (The older DECstation 5000 Model 200 can also be upgraded to the R4000, but will require a new mother board that is not customer-installable.) The list price for the upgrades will be $3,000 for Personal

Continued on page 26

on Sandpiper and Flamingo are compatible with existing two- and three-dimensional graphics boards, communications options such as FDDI (Fiber Distributed Data Interface), and storage options from DEC and third-party vendors. Sandpiper offers three Turbochannel slots, the same as the existing top-of-the line DECstation 5000 Model 240. Flamingo ups the ante to six Turbochannel slots.

The systems will feature standard Ethernet and physical interconnects, including ThinWire and10Base-T. Users will be able to network the systems immediately.

The systems also feature embedded I/O, including one internal and one external SCSI interface that work concurrently. Also featured will be built-in audio and two-dimensional graphics.

"I see these systems becoming the multimedia development platforms of choice. For example, you can put DECspin [Digital's video teleconferencing product] in one slot, FDDI in the second slot and another SCSI controller for even more disk in the third slot," said Gaubatz.

"You could have very much greater than 120 GBytes of data. so you could have huge databases. You could put ATM [asynchronous transfer mode] in a slot, you could put a token ring and you could put in a TurboChannel-to-VM interface," he added.

Analysts expect the Alpha workstatio to deliver 100 SPECmarks (more th double the performance of a VAX 90 Model 210).

Some analysts say Flamingo will op ate at 80 to 120 SPECmarks with 5 MBytes of memory. In comparison, T DECstation 5000 Model 240 rates 3 SPECmarks and has a maximum mem ry of 480 MBytes.

Flamingo will offer graphics capabil of 1.2 million three-dimensional ve tors/sec. and 270,000 Z-buffered tria gles/sec., according to company doc

Continued on page

Opening PC Windows in a Workstation World

Even though workstations have been made easier to use with graphical interfaces such as DECwindows, for some users there's just nothing like comfortable MS-DOS and their favorite PC applications.

DOS aficionados who have Digital Equipment Corp. workstations can get the best of both worlds without squeezing a second machine onto their desktops. Rather, a software product called DEC SoftPC provides a complete DOS environment, including access to users' existing DOS files and applications.

DEC SoftPC is available in a $595-pre-user version for both VMS VAXstations and a $725 version for RISC/Ultrix DECstations. It enables users to retrieve and share data among the different operating system environments. Users of VT220 terminals or X terminals connected to workstations that run SoftPC can also use the DOS emulation environment.

Although the software provides emulation of a PC AT-class machine (based on Intel Corp.'s 80286 plus a 80287 numeric coprocessor), performance is actually better because the application is running on a more powerful workstation. According to Digital's testing, DOS applications can run anywhere from one-and-a-half times as fast as a PC AT on the VAXstation 4000 VLC to more than three times as fast on a VAXstation 4000 Model 60 or a DECstation 5000 Model 200. At the top is the VAXstation 4000 Model 90, seven times as fast as a PC AT.

The latest release of DEC SoftPC, version 3.0, adds several features to the basic package that runs MS-DOS 3.0. Resizable windows are now available. Video emulation includes VGA (Video Graphic Array), EGA, CGA and Hercules, as well as MDA on the VT220. In addition, a native MS-Windows driver provides higher performance with Windows-based applications. As before, multiple DEC SoftPC windows can be opened simultaneously.

DEC SoftPC provides a complete DOS environment for users of Digital workstations.

Users can set up two hard disks of up to 32 MBytes each, designated C and D. LIM 4.0 expanded memory, up to 32 MBytes, is supported.

DOS files and applications on 3.5-inch or 5.25-inch diskettes can be accessed at the workstation if it has a local floppy drive. If there is no local floppy disk, SoftPC can attach to a PC and use its floppy drive in a feature called SlavePC.

If the workstation or X terminal running DEC SoftPC has a mouse attached, it can emulate a Microsoft bus mouse in the DOS environment.

Communications ports, COM1 and COM2, map to the serial ports of the system running DEC SoftPC. Printer connections, LPT1 and LPT2, map to the serial ports or to a spooled device. Digital support literature warns that communications software should be tested before purchasing because of the differences in signaling on the PC and the VAX or RISC processors and differences in the way those processors handle interrupts compared with a PC chip. However, according to the company, many communications programs do work correctly.

By the same token, Digital has tested hundreds of PC applications but does not guarantee that all of the tens of thousands of available DOS applications will run.

DEC SoftPC for Ultrix requires 8 MBytes of main memory to operate in conjunction with Ultrix Worksystem software. Running in a VMS environment, DEC SoftPC alone requires 2 MBytes of main memory; when running in conjunction with DECwindows it needs 6 MBytes. Digital recommends, however, using it with more memory to improve performance. Disk space requirements are 7.5 MBytes in Ultrix and 15.2 MBytes in VMS. ■

DEC's Spin on Multimedia

Even though they are working in different locations and in some cases, different states, a group of Digital Equipment Corp. software engineers see ch other every day – without ever leav- g their offices.

Networking engineers in Littleton, ass., software developers in Nashua, H., and their boss, Don Gaubatz, vice esident of workstations in Maynard, ass., consult by talking to video cam- s while sharing screens of text and gram specifications. The interactive, e consultations are made possible by a le-known application, DECspin tele- nferencing software.

Two FDDI (Fiber Distributed Data erface) networks loop 54 miles ween the Nashua and Littleton plants d between the Littleton and Maynard ilities, with 10 DECstation 5000s pro- ing the data transmission power, plained Jack Toto, multimedia mar- ing manager at Digital.

The primary benefit I get from having Cspin on my desk is I can use it hout thinking about it," said Gaubatz, o is used to talking to a TV camera unted on his workstation. "I can play h DECspin in a very user-oriented y and then feed my reaction to the velopers through the DECspin user erface."

Previously, Gaubatz communicated h his project workers by telephone. hen we communicate over DECspin, r conversations are usually shorter. I nk that's because when we talk face to e, the human communication band- dth is much higher," he said. "I get the vantage of seeing the functionality of Cspin right on my desk and the vantage of talking to the other sites hout spending the time traveling to m."

DECspin, a multimedia application ated by Digital to speed software velopment, is being used in the devel- ment of DEC multimedia software. e use it in-house as an engineering l as well as to facilitate meetings," said to.

Gaubatz can dial up engineers, ask estions and share and modify engi- ring drawings if necessary without ing to drive 45 minutes each way ween facilities. "In this economic cli- te, you can't have key personnel wast-

Webb Chappell

Sitting at a DECstation 5000, Digital's Don Gaubatz uses DECspin teleconferencing software to consult with engineers and developers at distant DEC offices.

ing that kind of time away from the development process," he said.

DECspin is currently available only for DECstation 5000s. Toto said that Digital is looking toward providing future versions for other platforms, including Sun Microsystems Inc. and Hewlett-Packard Co.

DECspin is designed to work with several pieces of multimedia hardware, which are included in the price of the run-time license. The hardware consists of a DEC video card, a frame buffer card, an audio card and a distribution box. The audio card is built into the Personal DECstation 5000 Models 20 and 25. DECspin loads on each machine participating in the teleconference, transmitting live video and audio among them. The video originates from cameras mounted on the workstations. The telephone handset or headset plugs into the distribution box, which plugs into the workstation.

Digital is developing a compression board based on industry standard JPEG (Joint Photographics Experts Group). The compressor will enable images to be captured, compressed, sent over the network and decompressed at their destinations. In tests, the JPEG board used with the DEC NS 600 hardware router over T1 lines from Chicago to Boston transmitted 11 to 15 frames per second as opposed to about two frames per second without compression, Toto said. The frame buffer card and the video card will be included in the JPEG board. ■

WORKSTATIONS *from page 24*

ments. In comparison, the DECstation 5000/240 offers 445,000 2D vectors/sec. and 436,000 3D vectors/sec.

Sandpiper is suited for two-dimensional simulation and mapping, CASE and logic simulation, the documents indicated.

Gaubatz said the SPECmark ratings for Sandpiper and Flamingo have not been finalized. "We have our compilers maturing on a very frequent basis. Once you get the hardware in place, once you figure out the feeds and speeds – then you continually evolve the compilers.

"The compilers right now are in a very fast state of evolution and they literally improve the preliminary SPECmarks of these things every week. So we can't say what the SPECmarks will be by the time the machines come out," he said. ■

It's All in the Chip

The 64-bit Alpha CPU rates 150 SPECmarks. Known as the 21064, the chip's maximum clock rate is 150 Mhz and its peak MIPS rating is 300. Currently, the R4000 chip from MIPS Technologies Inc. is the only 64-bit chip on the market. It has a maximum clock rate of 50 Mhz, a peak 100 MIPS and 70 SPECmarks.

At 100 Mhz, a peak 200 MIPS and 120 SPECmarks, Hewlett-Packard Co.'s Precision Architecture RISC 7100 comes closest to Alpha performance – but is a 32-bit chip.

The former MIPS Computer Systems Inc., which recently merged with Silicon Graphics Inc. and is now known as MIPS Technologies Inc., said it will take the R4000 to 150 Mhz by the end of 1992 and has targeted 200 Mhz for the second half of 1993. The Alpha chip differs from the R4000 because it incorporates 15 VUP (VAX units of performance) instructions, including VAX floating point.

Pathworks

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example, that its support for the Banyan Vines network operating system is "coexistence only" right now. And it has still to make a firm commitment to SCO Unix support.

Digital claims to have a unique breadth of support planned for Pathworks' future. But even product managers within Digital concede that users will continue to be the judge of whether existing support or future support in Pathworks meets their needs for PC integration. ■

R4000 Snap-in Upgrades

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DECstations and DECstation 5000 Model 133; the upgrade for the Model 240 will cost $4,000.

The Personal DECstation family, which currently ranges from $3,995 to $6,995 in entry-level, diskless configurations, features a main memory capacity of 40 MBytes. Onboard audio and the availability of live video input options make these systems capable of running multimedia applications. The systems have two TurboChannel bus slots, integral SCSI one RS-232 synchronous/asynchronous port, and, like the rest of the current DECstation models, onboard 802.3 Ethernet as well as optional multiple FDDI and multiple 802.3 Ethernet.

The DECstation 5000 Models 133 and 240 have main memory capacities of 128 MBytes and 480 MBytes, respectively. They feature three TurboChannel slots, integral SCSI and two RS-232 synchronous/asynchronous ports. In entry-level, monochrome diskless configurations, the Model 133 is priced from $8,495, and the Model 240 is priced from $11,995.

According to Richardson, key to the upgrade strategy is the fact that virtually all current DECstation hardware, such as graphics options and storage peripherals, will work seamlessly with the new architecture.

The RISC workstation family was the first set of Digital systems to use the 100-Mbit/sec. TurboChannel bus interface, which is also the peripheral interface for future Alpha systems. DEC has promoted TurboChannel as an open interface and encouraged the development of third-party peripherals through its Tri/Add program.

Among third-party Turbochannel options listed in a recent Tri/Add catalog are network adapter cards, data-acquisition interfaces, serial and parallel line interfaces, IPI (Intelligent Peripheral Interface) disk drive controllers and real-time video interfaces.

Turbochannel-to-VME bus interfaces enable customers to use industry-standard VME peripherals with their DECstations as well.

Also, DECstation support for standard SCSI peripherals ensures that a wide variety of inexpensive storage devices can be used with the workstations.

The entire line of Digital's TurboChannel-based graphics options v go forward with R4000-based syster At the low end of the graphics line the MX options, a single-plane, hig resolution (1,280 x 1,024 pixels) mor chrome frame buffer that takes up o TurboChannel slot. The TX graph option was designed for use in conjur tion with the DECvideo multime options and provides a socket for t live-video daughter card. This high-res lution option contains a 24-bit true col frame buffer and an independent 8- color-mapped frame buffer; it takes one TurboChannel slot.

Another one-slot graphics option the HX, which has 8-bit planes wi 1,280- x 1,024-pixel resolution. Uniq to the HX is a Smart Frame Buffer cu tom chip that provides acceleration f two-dimensional line drawing, stippl

> *A key to the upgrad strategy is the fact that virtually all current DEC station hardware will work seamlessly with the new architecture.*

polygon filling, pixel copy and Boole operations.

Offering a higher level of graphics pe formance are the PXG, PXG+ and PX Turbo+. All implement an advance graphics acceleration architecture, b with differences in form factor and pe formance. The PXG and PXG+ occup two TurboChannel slots, while t Turbo+ is a triple-width card. At the to of the line, the Turbo+ has 24 imag planes, a 24-plane double buffer, 2 plane Z-buffer and 24-plane buffer f offscreen storage of pixmaps.

One uncertainty that remains in th DECstation upgrade strategy is wheth future hardware options will be compat ble with the R4000-based workstation A Digital spokesman said that althoug all TurboChannel options will physicall fit into the older systems, it will be up t the options designers to write the appro priate drivers for the DECstations. ■

It's Not a File Server

DEC's Infoserver offers virtual disk and tape services to clients in multiple environments.

One way to begin a description of Digital Equipment Corp.'s InfoServer network storage device is to say what it is not – it is a file server.

The InfoServer is a unique device that ers the opportunity for LAN users to re SCSI devices," said Mike Lynch, oServer marketing manager at Digital. ne benefit to Macintosh, PC, VMS l Ultrix clients across a LAN is that w they have at their disposal up to 14 SI devices they did not have to go out l buy."

ccording to Lynch, the differences ween InfoServer and generic file vers are basic. The InfoServer, which ased on the MicroVAX 3100 proces-, offers virtual disk and tape services clients in multiple environments and is imized for handling multiple reads l seldom writes. In contrast, file vers offer clients a variety of file-based vices, including the opportunity to share files transparently but only across a bounded LAN environment. In their favor, file servers deal equally well with multiple writes and multiple reads.

Underlying the services provided by InfoServer is Digital's LASTport (Local Area Storage Transport) protocol. LASTport is a protocol developed by Digital that optimizes the efficiency of read functions and ensures the heterogeneity of the InfoServer by transferring data at the block level.

LASTport was built using an asymmetrical client-server model that contrasts sharply with DECnet's peer-to-peer model. The asymmetrical client-server model allows LASTport to speed interactions between clients and the server across a LAN by handling up to 255 simultaneous transactions and eliminating the need for clients to send acknowledge messages back to the server.

System managers can hang up to 14 different SCSI devices off the InfoServer, including CD-ROM drives, hard drives and tape drives. The InfoServer 150 ships with an internal 120-MByte RZ23L hard disk and an RRD-42 CD-ROM drive already installed on one of its two 7-port SCSI buses, leaving a total of 12 SCSI ports open.

To users, the InfoServer simply looks like another SCSI device, another area

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Peter Ensenberger/Black Star

ll Delhan, coordinator of computer vices at Mesa Community College Arizona, uses two InfoServers ove] to provide virtual disk ser-es to 12 diskless, 386-based DOS rkstations scattered around the lege's library. Behind Delhan is tems technician Carl Nelson.

Speaking with **Larry Cabrinety**

Larry Cabrinety is vice president of the Video, Image and Print Systems Group for Digital Equipment Corp. in Westford, Mass. The group is responsible for producing Digital's printers, DECprint Architecture, imaging systems, and X Window and other terminals.

How do you characterize the change in your unit as you observed the movement toward end user computing?

"We decided three years ago to stop just addressing the Digital base of customers. We decided that we had to start offering the customer the lowest-cost solution that gets the job done. There was to be no more of this, because we're a workstation vendor, we want to sell you a workstation. We want to supply text terminals that can put up PC Windows when hooked to a 386 or 486 machine. That's a $500 seat. Most companies have not done that.

"The desktop was the fastest-growing area of computing, and we said to each other, 'Hey, guys, let's try to do it right.' It was part of the restructuring here."

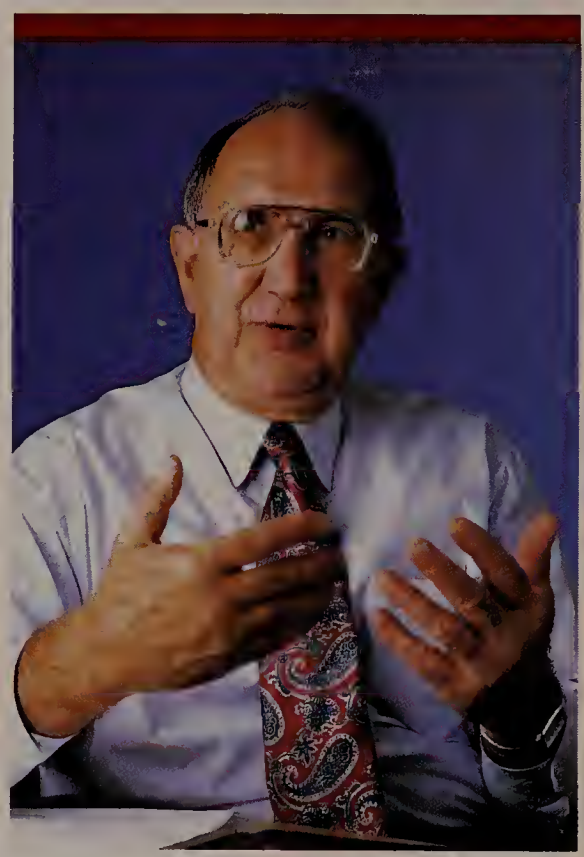
What's an example of your investing in this approach?

"Every network needs a good shared printer. Nobody can print on a network the way we can. We have invested $15 million in software for our DECprint Architecture to print anywhere on the network. We have the ability to queue up jobs (with non-sequential priority). We can reroute the job to another printer. We have patented the ability to do end-up image, or printing multiple images on one piece of paper. If you received 10 memos during the day, you can order them printed out on one sheet to take home and read. We can reroute the job to another printer. We can deliver bar codes anywhere on the network and print them out.

"DECprint provides a two-way communication capability. We printed out a technical manual in Cannes, France, from Westford, Mass., and we knew when the printer in Cannes was out of paper or jammed up. We have the power on the network to do these things.

"The DECimage part of the architecture allows you to print scanner-style images at printer speed. We can produce resolutions of 1,000 by 1,000 dots per inch off an image produced from a 300- by 300-dot-per-inch engine. It makes the lines much crisper. We call it image enhancement.

"And the MIS manager has full systems control of t printer. He knows when it's out of toner or paper. He c take full control of that printer and get the job done."



Webb Chappell

We decided three years ago to stop just addressing the Digital base of customers. We had to start offering the customer the lowest-cost solution that gets the job done.

But is this in the Digital enviro ment only?

"DECprint can drive about half the PostScript laser printers out there takes some fine tuning to get it to r on third-party printers — not a lot. I we can't support all printers, just big runners [established, high-volu printers]. By the first quarter of 19 we will have DECprint playing Hewlett-Packard printers. (But Dig has not set pricing.) IBM's RS6000 a System V machines will be able to r printers using DECprint by first quar 1993.

"We are also aiming to have PCs Novell NetWare able to make use DECprint printer services.

"SunQuest Information Systems Tucson, Ariz., resells our DECpr software on Sun machines."

Digital used to sell a half-milli dumb terminals a year. Isn't th business declining and what do y see coming onto the desktop in place?

"There are six million dumb terr nals sold worldwide [per] year no and Digital sells 600,000 of the We're expanding into the private lab OEM market. Three years ago decided to go after the worldwide ba of computing.

"Digital used to produce ANSI ch acter-cell and graphics terminals. Th was it. Now we will do [IBM] 327 Tektronix 4270 or whatever you wa We have VT420 PCTerm that can run off a multiuser Intel PC for M DOS or SCO Unix applications. We make a terminal do whatever you wa it to do.

"The terminal market is still evo ing. The world of the X Window System will take it to new dimension. X will make the terminal market start grow again. We plan to run X Window terminals on tok ring next spring. We'll have an InfoServer on token ri feeding X Window terminals. Not everybody wants to bu PC for every worker.

"The world is changing rapidly. Some workstation ve dors disavow that an X terminal can be tied to a workstati but it's going to happen. It lowers the cost per seat." ■

DEC Printers Talk Back

A Digital Equipment Corp. engineer in Westford, Mass., delivered a technical document to a colleague the next day in Cannes, France. stead of trying to catch the Federal press pickup, she sent an electronic of the document over DEC's internal twork to France, ordering a printer re to output it.

When the printer ran out of paper, she s informed of the interruption by sen- s on the machine and she was able to ve an E-mail message for her French nterpart to reload the paper tray in morning. Once the reload occurred, printer continued to give prior- to the technical document and ked up printing it from the nt where the paper had run t. Before his co-workers had own up for work, the French ployee had his document in e for the day's demonstrations.

xamples like this are the result DEC's $15-million effort to elop DECprint Architecture, a of networked software prod- s to maximize printer services, ording to Larry Cabrinety, vice sident of the Video, Image and nt Systems Group in Westford, ss.

Printers had to learn to talk k. They had to tell the user out their status, whether they re low on paper or other con- nables, whether they received a , when they finished a job and er things that allow remote nting to be as efficient as local print- ," said Allan McDonald, DECprint rketing manager.

Most printer usage on a network is rked by one-way communication, eed Angele Boyd, director of print earch at the International Data Corp., market research firm based in Fram- gham, Mass. "DEC offers more two- y communication than is typical in er environments. DEC will give the r little cheat sheets – codes that can used to order two-up printing [multi- pages or images on one sheet]" and er special processes, she said. If the nter to which a task is sent is not ilable, DECprint functions will oute it to another printer on the net- rk and let the user know, Boyd said.

DEC relies on standard PostScript language within DECprint and is designed to work with Digital-produced printers, and some third-party products that support PostScript. Many PostScript printers are not equipped with the sensors and communication facilities needed to supply DECprint services, noted Boyd.

Under the DECprint Architecture, Digital has released a number of products that allow users on DECnet, TCP/IP or Pathworks (Digital's PC and LAN connectivity package) to maintain two-way interaction with a networked PostScript printer. DECprint Printing Services, for example, provides network services and printer feedback to users in DEC's VMS environment.

"Talking back was always part of VMS systems services," noted Mike Maynard, president of Integrated Management Resources Inc. (IMR), a market research and consulting firm in Stow, Mass. "Now it is more standard and more graphical in nature. Also, under DECprint, the printer talks back to you at a finer level of granularity."

Part of the architecture outlines standards for applications that create documents, clients that accept print requests from applications, and the printers and services that execute a print request.

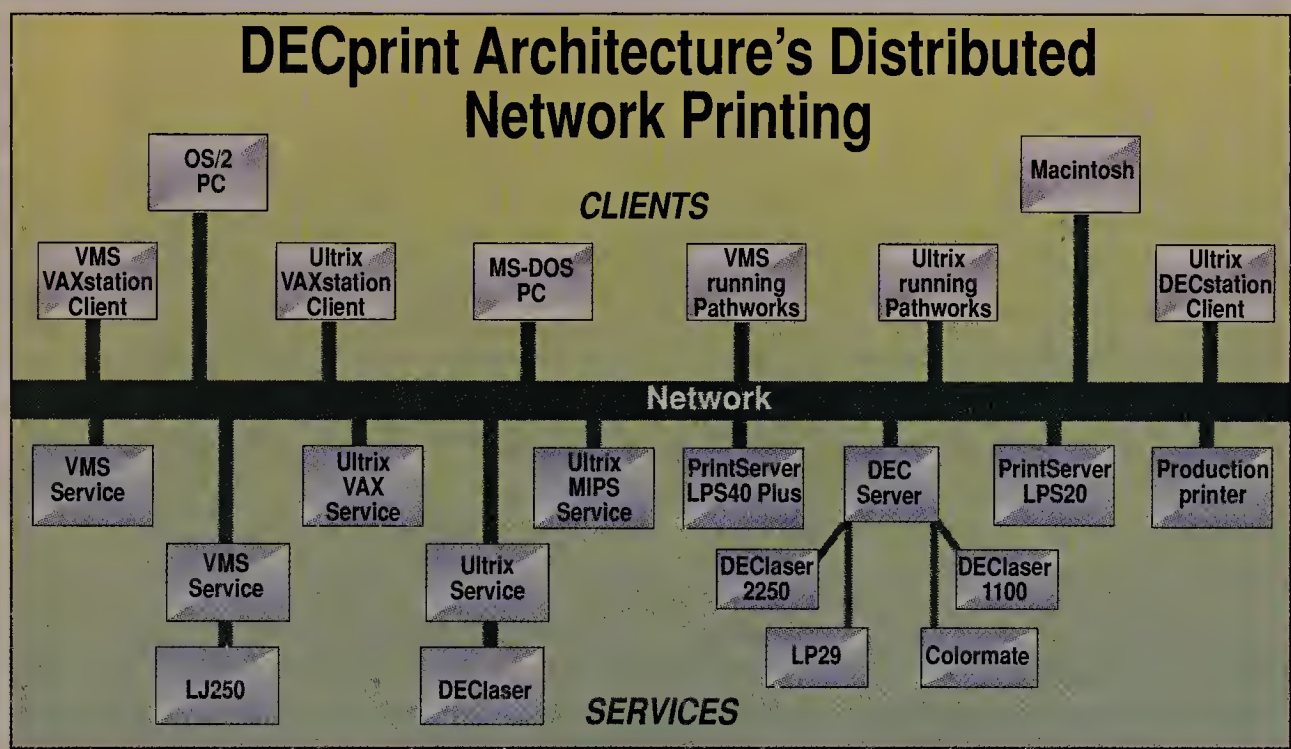
These standard functions are generally implemented in DECprint Client or DECprint Service software. DECprint Clients offer a standard user interface, job assembly functions and a job manager. DECprint Service packages offer job scheduler and print supervisor functions.

DECprint Service software is currently available only for VMS hosts. Digital plans to migrate the services to Ultrix and other Unix platforms, McDonald said. The current batch of DECprint software ships with all Digital PostScript printers (such as the PrintServer family of network laser printers) and is available for use with PostScript printers from other vendors. DECprint software packages for third-party PostScript printers are loaded directly onto the printers and are licensed separately.

An example of the extended flexibility of the DECprint Architecture is its handling of DECfonts, a separately licenseable part of DECprint. Users who have DECfonts do not need to have all fonts resident on all printers. With DECfonts, the fonts are distributed with the document so that any PostScript printer can print any DECfonts document.

"DECprint products take advantage of the richness of the PostScript language to increase the efficient use of the shared printing resource," McDonald said. Nevertheless, selling DECprint requires convincing a customer that printers are a

Continued on page 32



DEC has released a number of software products that allow users on DECnet, TCP/IP or Pathworks to maintain two-way interaction with networked PostScript printers.

Dumb Terminals Remain Preferred Device of Many

As Digital's VT dumb terminals move into the future, they are taking on a more intelligent look, offering split-screen capability and looking towards windows functionality, while maintaining the rock-bottom prices customers have come to expect.

"Eighty-five percent of people use computers for word processing and mail only, so these terminals are not going to go away," said Larry Cabrinety, vice president of Digital Equipment Corp.'s Video, Image and Print Systems Group in Westford, Mass. "Now we are getting to the point where it's easier to put more into the terminals than to lower the price of the terminals as they are now."

Besides windowing capability, future terminals are likely to add such features as clocks, calculators and mice. Many are moving from a character base to a simple dot-matrix base, which would facilitate bit-mapped graphics and possibly color. Digital currently is watching to see if a market will develop for these features and functions, said David Cotton, text terminal business manager. "Color tubes cost more and we need to maintain a two-to-one price advantage over PCs with color. We do get requests for color on these terminals, but at this point it is a niche market," he added.

Currently DEC's line of traditional terminals includes the VT420 (which replaces all earlier models), the VT420 PCTerm, the VT330+ and the VT340+. The VT340+ is Digital's only color terminal. All models will run the thousands of available ASCII and ANSI application packages and do simple line drawings, graphics and spreadsheets. The PCTerm models can run monochrome PC applications as well. Digital is working with the MDOS (Multiuser DOS) Federation to establish a standard for PC terminals.

The VT420 PCTerm is a text terminal adapted for SCO (Santa Cruz Operation) Unix and MDOS PCs, as well as a desktop system for accessing PC applications running on multiuser Intel Corp.-based PCs and Unix systems. It uses a PC keyboard to access applications running on SCO Unix and SCO Xenix operating systems and MDOS systems. It provides the functionality of Digital's standard VT420 terminal, including single- or dual-session operation with full- or split-screen viewing and text windowing. Both the VT420 and the VT420 PCTerm are priced at about $629. The VT330+ and VT340+ offer dual sessions, graphics and split-screen capability. The VT340+ offers a 16-inch color monitor. The terminals are priced at about $1,885 and $2,725 respectively.

DEC's line of terminals includes the VT340+ with a 16-inch color monitor.

DEC's terminals are now becoming international in scope with support for a number of foreign languages. They support ISO (International Standards Organization) Latin 1 standard for Western Europe and ISO Latin 2 standard for Eastern Europe. "Digital is establishing a market presence for these terminals in the former Soviet bloc countries," according to Cotton. Some Asian languages are available but are not yet in the mainstream and so are not cost-effective, he added.

"We have run 10 different languages

Continued on page 32

X Termina

A telemarketing representati at a financial services co pany works from a Digi Equipment Corp. VX 2000 X terminal that ru off your department's RISC DECstati 5000. Similar systems are dedicated customer support, accounting, ord inventory and purchasing, all runni off Ultrix, Unix or MS-DOS hosts.

In the past, the representative wou have had to log in and out of four or fi databases to get information, a proce riddled with opportunities for keystro errors. With Digital's VXT 2000 term nals, however, users can have databa applications from different departme and heterogeneous hosts displayed they run simultaneously in windows their screens.

According to Digital representativ this scenario is accomplished every d by the 20,000-installed base of VX 2000 terminals currently in use. T function across heterogeneous hosts, second Digital product is needed, t InfoServer 150 network terminal serv according to Larry Cabrinety, Digita vice president of the Video, Image a Print Systems Group in Westford, Ma

This VXT 2000 terminal family is line of nine X-windowing termin introduced last December, ranging fro monochrome, gray-scale or color ve sions in 15-, 17- or 19-inch monitors. the low end is the monochrome 1 inch, single-box VXT, complete with MBytes of main memory. At the hi end is the 19-inch, color VXT 219A te minal with main memory expandable 16 MBytes. All VXT systems a expandable to 16 MBytes.

The monitors' resolution is 1 dots/inch, with a flicker-free refresh ra of 72 hz. A choice of thick-wire, Thi Wire or twisted-pair Ethernet conne tions is available. All VXT terminals u the Motif window manager as their lo window manager.

The CPU for these systems is t SOC (System on a Chip) – the 1 microprocessor – the standard for t DEC MicroVAX 3000 and DECstatic 3000 families, with a 60-nanosecon clock speed. The SOC is compatib with all available software used on VA and DECstation systems.

The InfoServer150, also introduce last December, is a specialized termin

Digital's 'Universal Desktop Device'

ver that acts as a companion product to VXT 2000 family of terminals. Via a ivative of Digital's standard LAT ocal-Area Transport), the InfoServ- 50 uses the LASTport (Local-Area rage Transport) protocol.

ia LASTport, the InfoServer 150 ers high network performance by loading host functions onto the server provide automatic load balancing oss the network, automatic downline ding of fonts from the host and imited virtual memory for the termi- s via demand paging. Additional ions are available, such as the okreader service, which is the ability tore large amounts of information on CD-ROM that can later be accessed l displayed on an X terminal, accord- to Cabrinety.

The InfoServer allows the network nager to segment the network traffic particular portions of Ethernet by ividual work group," said Vic Belle- re, Digital's program manager for the T 2000 line in Westford, Mass. Ter- nals will boot from the InfoServer; y will get their virtual memory, win- v manager, fonts and DECterm from InfoServer so that the only thing the r needs from the host via TCP/IP or T is the application itself.

he VXT terminals, unlike traditional terminals, which functioned neatly host-based configurations, are specifi- y targeted for distributed, client-serv- omputing in multivendor networks, ording to Bellemare.

We offer total automatic load balanc- across the network, via LASTport, ich automatically moves the resource l from the host so that it does not ng down the system when resources heavily used," Cabrinety added.

open system?

Digital's competitors will throw nes at the InfoServer, saying that it is a concept and that it improves effi- icy, but they will say it is not a true n system," said Jack Roberts, principal lyst for Graphics and Displays at aquest, a market research firm in San , Calif.

ut, according to Digital, VMS or er network systems managers who st manage multivendor networks and Hewlett-Packard, Sun, VMS, Ultrix MS-DOS users on them, can cus-

The VXT 2000 terminal family includes monochrome, gray-scale or color versions in 15-, 17- or 19-inch monitors. All VXT systems are expandable to 16 MBytes. The monitors' resolution is 100 dots/inch, with a flicker-free refresh rate of 72 hz.

tom-configure groups of users.

"The VMS systems manager also has complete systems management configuration control at his fingertips with our new VXT terminals and InfoServer," Cabrinety added, claiming that competitive systems do not offer that facility.

"You can't do that just by putting X on a system and expecting it to be easily configured. With our system, we have virtual unlimited memory," he added.

As an example of dedicated configuration capability, Cabrinety said the VMS network manager can configure 20 VXT terminals to be used by technical support users, 20 for telemarketing, 20 for online transaction processing and 20 for customer support, all running windows from multiple hosts simultaneously.

Market analysts cited another advantage of Digital's VXT/InfoServer solution: It saves systems management expenses by having one network manager at a central location for X terminals on desktops across a multivendor network. The network manager can handle X terminals in a multivendor network of MS-DOS, Unix, Ultrix and VMS systems from one location.

"If you want to see where X is going, look at someone who is managing 200 to 300 VAXs from a technical support site," said Wes Melling, program director for Midrange Computing Strategies for the Gartner Group in Stamford, Conn. "That gives you a model of the relative ease with which distributed computing, intelligent workstations and X terminals will be managed by the middle of the decade."

Workstations are approximately 50 percent higher in annualized systems management costs than X terminals. PCs cost approximately 30 percent more in annualized systems management costs than X terminals, according to Cabrinety.

Ultimately, Digital wants its VXT 2000 family to become the "universal desktop device," Cabrinety said. It expects to sell 25,000 by the end of 1992, 40,000 in 1993 and 80,000 in 1994.

A 15-inch VXT monochrome terminal with 4 MBytes of main memory is priced at $1,595. A high-end, 19-inch, color VXT terminal with 4 MBytes of main memory is $5,395. An InfoServer costs $6,300, with up to 20 seats per server. ■

InfoServer

Continued from page 27

where the InfoServer contrasts with file servers. The InfoServer does not impose a file system on its virtual devices. For DOS clients accessing one of the InfoServer's CD-ROM drives, that drive will simply look like any other drive (generally, G: or higher). For Apple Computer Inc. Macintosh clients, there is a separate InfoServer icon provided in the InfoServer client software. Any client can mount a volume stored on the InfoServer and it would appear the same as any other locally stored volume.

Reaping the benefits

One system manager who understands the difference between an InfoServer and a file server and has been reaping the benefits is Bill Delhan, coordinator of computer services at Mesa Community College outside of Tempe, Ariz. Delhan is using two InfoServers (an InfoServer 100 and an InfoServer 150) to provide virtual disk services to 12 diskless, 386-based DOS workstations scattered around the college's library. All network services to the PCs are provided by Digital's Pathworks.

The InfoServers are connected to each other and to a VAX 6430 in the college's administration building via thick-wire Ethernet. Delhan emphasized that the InfoServers do not count on the VAX for any file services. They provide any needed temporary disk services from their own internal hard drives to the clients over ThinWire Ethernet.

At the 21,000-student college, the 12 CD-ROM drives in the InfoServers are primarily being used to provide read services to the client terminals for such things as reference materials, periodical abstracts, textual information and maps. In order to take greater advantage of the speed of the InfoServer, computer service technicians at the college removed many of the search engines from the different CD-ROM disks and loaded them directly into InfoServer memory.

"By taking the search engines on the different CDs off the disks and [putting them] onto the InfoServer, we've found that searches go a lot faster," Delhan said. ■

DEC printers

Continued from page 29

shared resource and that a print strat can increase efficiency and save mor he noted.

With low-end laser printers dropp below $1,000, few companies have s the need to implement extensive p strategies. Instead of having a strate company MIS directors respond to u demand by buying an additional prin The result is a majority of a compar printers standing idle most of the ti while the cost of maintenance goes McDonald said.

Printing with a high-capacity prin such as Digital's PrintServer 32 (at pages per minute), can cut a compar cost per page. When used with a ju cious mix of personal printers, the n worked PrintServer's ability to ch out 150,000 pages per month makes f cost-effective print strategy, he said.

"Printing is not really looked at most companies as a strategic issue. It tactical issue," said IMR's Mayna "Until they can't get out a report, peo don't recognize the printers." ■

Dumb Terminals Remain Preferred Device for Man

Continued from page 30

simultaneously off one host. This means you could have 10 employees working in 10 different languages on terminals all hung off the same host," said Cabrinety. These terminals are the lowest-cost display device you can use to communicate in different languages, he added.

Another factor affecting the terminal market is the recently established AlphaWindow standard, which enables windowing capability on text terminals. The standard was established through the Palo Alto, Calif.-based DIA (Display Industry Association), which creates hardware and software standards for display terminals. Digital is a member of the association.

AlphaWindow terminals achieve windowing through a display server in firmware on the terminal itself working with a window manager software package that loads on the host computer. The window manager drives the terminals and the terminals run the windows. The AlphaWindow standard defines the interface between the window manager and the terminal in a series of escape sequences that define the windows and identify the sessions running in them. The standard is expected to expand to define a standard for graphics-capable terminals.

Priced in the $600 range, the AlphaWindow terminals will run all existing character-mode applications – roughly 80 percent of all existing applications without any modifications and use RS-232 serial communication lines. The windowing functions include running multiple applications, transferring information between applications and resizing. Other features are scroll bars, icons and buttons. AlphaWindow terminals can attach directly to a multiuser system such as a DOS PC or a Unix system.

While a number of vendors have brought out AlphaWindow products, Digital is taking a wait-and-see approach.

While a number of vendors includi Cumulus Technology Corp. a Applied Digital Data Systems Inc., h brought out AlphaWindow produc Digital is taking a wait-and-see approa The company declined to discuss its s cific plans, if any, to develop su machines.

"AlphaWindow terminals are in o plans because windowing is the way the world. It's just a question of timin said Cabrinety. "People have a lot learn with regard to making AlphaWi dow terminals and it might not pay to among the first out with su machines," Cotton added.

With 5.5 million terminal devices s last year (according to International D Corp., a market research firm based Framingham, Mass.), dumb termin appear to remain the smart choice fo multitude of customers. "The machines fit in nicely," said Cabrine "They give users all the basic applic tions, are simple to operate, inexpensi and work with any kind of a host on a kind of a network. Realistically, trac tional terminals will be around the r of this decade." ■

DIALOG BOX TIPS

Wielding Wild Characters in Word for Windows

When I create a document in *Word for Windows*, I often need to use dashes, the copyright symbol, the registered trademark symbol, and other characters that are available only via combinations of the <Alt> key and digits or through the Insert•Symbol menu.

Rather than trying to commit every sequence of keystrokes to memory or select what I need from a table with 256 options, I wrote a macro [**LISTING 1**] that gives me easy access to the symbols that I use most. The macro creates a dialog box with buttons for the special characters and assigns each a shortcut key for fast access. It then uses WordBasic's Insert statement to send the character.

Vijay Ramachandran
Armonk, New York

Editor's note: To create this macro, select *Tools•Macro*, type **InsertSpecial**, and click *Edit*. Once you're in the macro editor, type the macro [**LISTING 1**] and press **<Ctrl>-<F4>**. This macro is pointless unless you can get to it easily from the keyboard: Select *Tools•Options* and press **K** to get to the Keyboard Options dialog box; from here assigning the macro to the key of your choice is pretty self-explanatory.

I made one slight improvement to this macro, turning the original OptionButton commands to PushButtons. With this change, once the box is up, PushButtons allow you to insert your selection with one keystroke, whereas OptionButtons require two (the hot key and <Enter>). If you subscribe to PC World Online, you'll find the macro in a text file called SPECCHAR.WWM, in the archive file DEC_DIAG.ZIP, in the "Featured in December" folder.

More Music for Your Money

When I first started using the *Windows 3.1* Sound Recorder accessory and my Sound Blaster soundboard to create digital recordings, I was disappointed to find out that Sound Recorder had a 1-minute time limit. Luckily, I discovered a trick that makes it possible to record longer material—if you have enough memory.

Here's how: Launch Sound Recorder, then record 1 minute of silence and save the recording under the name BLANK.WAV (or anything that's easy to remember). Once this is done, use *Edit•Insert file*, select *BLANK.WAV*, and click *OK*. This will insert another copy of the minute of silence, effectively doubling the amount of time available for new recordings.

If you have enough memory left, you can repeat the last two steps and insert still more time. (The size of Sound Recorder's digital recordings depends only on their length, not what you recorded; a 60-second recording is invariably 661,544 bytes.) Once you've inserted the desired amount of time, you can press the Rewind button and begin recording.

In my system, which has 4MB of RAM, I can increase the recording time to 3 minutes, enough to record a short song, if Sound Recorder is the only *Windows* program I'm running. You can even use Control Panel to change the *Windows Start* and *Windows Exit* sounds to your favorite songs.

Steven Singer
Nelliston, New York

Editor's note: This technique is a wonderful way to get around the initial time limit of *Windows'* Sound Recorder application. However, if *Windows* is slow enough to annoy you, adding music and sound effects could make it worse.

Using SORT to Unsort

I recently needed about a dozen randomized name lists in order to assign students to groups. It occurred to me that

```
Sub Main
Begin Dialog UserDialog 325, 290
  Text 10, 6, 144, 12, "Special Characters"
  PushButton 10, 24, 210, 21,   "E&m Dash"
  PushButton 10, 47, 210, 21,   "E&n Dash"
  PushButton 10, 70, 210, 21,   "&Open Double Quote"
  PushButton 10, 94, 210, 21,   "&Close Double Quote"
  PushButton 10, 118, 210, 21, "Open &Single Quote"
  PushButton 10, 142, 210, 21, "&Apostrophe"
  PushButton 10, 166, 210, 21, "Co&pyright"
  PushButton 10, 190, 210, 21, "&Registered Trademark"
  PushButton 10, 214, 210, 21, "One &Fourth"
  PushButton 10, 238, 210, 21, "One &Half"
  PushButton 10, 262, 210, 21, "Three &Quarters"
  CancelButton 230, 3, 88, 21
End Dialog
Dim Characters As UserDialog
On Error Goto Goodbye
ChoiceMade = Dialog(Characters)
Select Case ChoiceMade
   Case 1
    Insert Chr$(150)
   Case 2
    Insert Chr$(151)
   Case 3
    Insert Chr$(147)
   Case 4
    Insert Chr$(148)
   Case 5
    Insert Chr$(145)
   Case 6
    Insert Chr$(146)
  Case 7
    Insert Chr$(169)
  Case 8
    Insert Chr$(174)
  Case 9
    Insert Chr$(188)
  Case 10
    Insert Chr$(189)
  Case 11
    Insert Chr$(190)
  Case Else
  End Select
GoodBye:
End Sub
```

LISTING 1: This Word for Windows macro gives you quick access to frequently used special characters.

PC WORLD

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```
@ECHO OFF
IF NOT "%1"==""" GOTO %1
SET | FIND "PROMPT=" > OLDPROMP.BAT
PROMPT Do you wish to answer Yes or No? [Y/N]
ECHO @CONFIRM Y > Y.BAT
ECHO @CONFIRM N > N.BAT
GOTO STOP
:Y
REM Commands for a "Yes" choice
ECHO You answered Yes to the question.
GOTO END
:N
REM Commands for a "No" choice
ECHO You answered No to the question.
:END
OLDPROMP
DEL Y.BAT
DEL N.BAT
:STOP
```

LISTING 2: This sample batch file shows how you can get user response to a yes/no question.

the DOS SORT routine had the ability to sort lists in seemingly random fashion. Ordinarily, you would use the command SORT < NAMES.DAT to sort the lines in the file NAMES.DAT in the usual fashion, by first character. However, if one uses the */+n* extension, sorting will begin with column *n* of each line. Thus, the (more or less) random characters in the names determine the ordering, giving a scrambled list.

For example, if the file NAMES.DAT contains the five lines:

Arthur
Gilbert
Rachel
Robert
Susanne

the command SORT/+3 < NAMES.DAT displays:

Robert
Rachel
Gilbert
Susanne
Arthur

The file containing the names (or any other words or lines to be scrambled) can be any ASCII file. First names, last names, and other information can also be included. Spaces and punctuation present no problem, because they have ASCII codes that DOS will use in sorting. The number of possible scrambled lists one can get depends only on the length of the lines one uses.

Lawrence Corrado, Manitowoc, Wisconsin

Editor's note: This is the first time I've ever heard of a sort utility being used to *un*sort names, but the idea is a good one. This technique can be used in almost any situation where groups of names need to be chosen at random—such as in simple games or while deciding on promotions within your organization.

Confirm or Deny

One way to allow a batch file to ask a yes or no question is to have it ask the question, terminate the batch, and let the user's answer serve as a command that starts the same batch up again. Here's a batch file **[LISTING 2]** that illustrates the technique.

The batch file asks the user a yes or no question, and two new batch files are created—Y.BAT and N.BAT. If the user answers 'Y', then Y.BAT runs, calling the original batch file again and jumping to the 'Y' routine; if the user selects 'N', the batch file goes to the 'N' routine. While the routines here are samples, in real life the batch file could let the user decide to log on to a server, load *Windows*, or whatever.

Emmett A. Dulaney, Muncie, Indiana

Editor's note: The clever thing about this batch file is the way it calls itself indirectly using a pair of temporary batch files. I've changed Dulaney's original program so that the question actually becomes the DOS prompt; DOS continues to ask the question until the user types 'Y' or 'N'. If you subscribe to PC World Online, you will find the batch file under the name CONFIRM.BAT, in the archive file DEC_DIAG.ZIP, in the "Featured in December" folder.

Gee-Whiz Icons in GeoWorks

GeoWorks comes with some interesting icons, but it displays every file—except its own programs and the files created in them—with the same two dull images. What's more, if *GeoWorks* doesn't recognize a data file's extension, it won't allow you to

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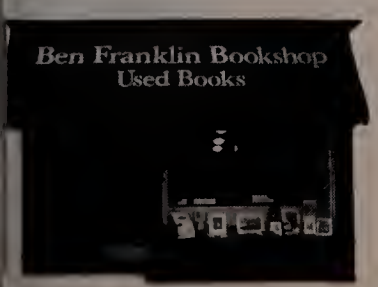

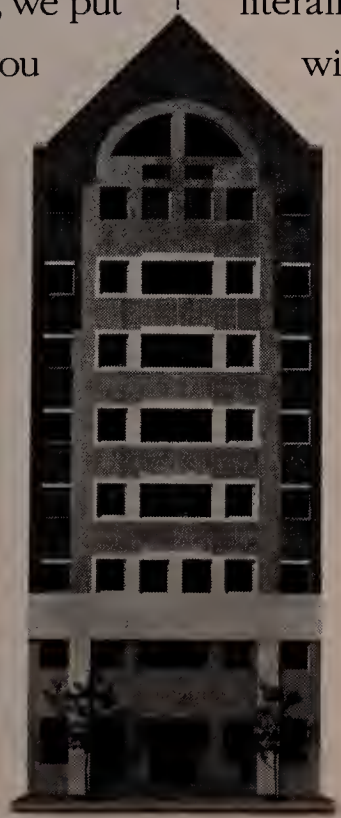

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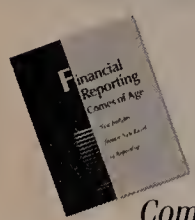

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Circle 207 on reader service card

launch a program and load a file by clicking the data file.

I've found a way to address both of these problems: Assign icons to non-*GeoWorks* files and programs, and load non-*GeoWorks* files into *GeoWorks* programs (most commonly Notepad) with a double-click. All you need to do to accomplish this is edit GEOS.INI (you must do this outside of *GeoWorks*, because *GeoWorks* keeps the file open while it's running).

Open GEOS.INI with a text editor, such as DOS 5.0's EDIT, and find the line that reads 'filenameTokens = {'. After this line you'll find a series of statements that associate file names and wild cards with icons and programs. For example, the line *.EXE = "gDOS",0 assigns all EXE files the standard "DOS in a box" icon. *.TXT = "FILE",0,"NPAD",0 is more complex: "FILE",0 assigns each TXT file the standard "file in a DOS box" icon, while "NPAD",0 tells *GeoWorks* to bring up Notepad and load the file when the icon is double-clicked.

You can add to these lines to give files the icon of your choice. I edit BASIC files frequently, so I added the line *.BAS = "plnr",0,"NPAD",0, which gives all BAS files a GeoPlanner file icon and loads them into Notepad when I double-click on them.

POWER TIP no. 269

WinWord Hot Spots

If you're a *Word for Windows* user, here's how to put a graphic inside a WordArt button: From inside *WinWord*, select Insert • Object • MS WordArt. Once the program is loaded, type the text you want at the top of the button, press <Enter> twice, then type the text for the bottom. Under Style, select Button, then click OK. Back in *WinWord*, click your WordArt button and select Insert • Frame. If you're asked about going into Page Layout mode, select Yes. Next, select Insert • Picture to insert a picture in your document, and frame it as described above. Move your picture into the circle and scale it to fit the space.

Chris Getchell
Richmond, Virginia

"I can't work my VCR and they're expecting me to understand this?"

–Richard Link, Administrative Assistant

"This was a big investment. I'm still waiting for the big return."

–Peggy Turner, CFO

"I thought you said these were going to increase productivity."

–Greg Collins, Office Manager

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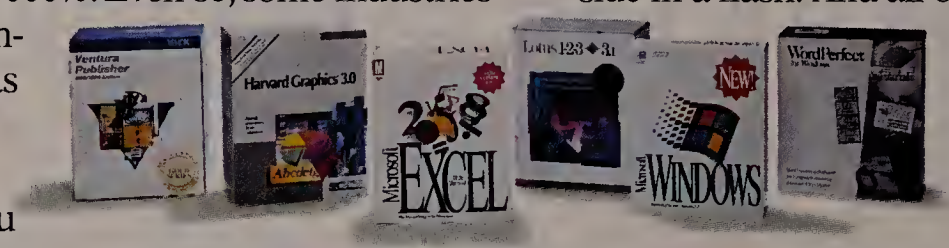

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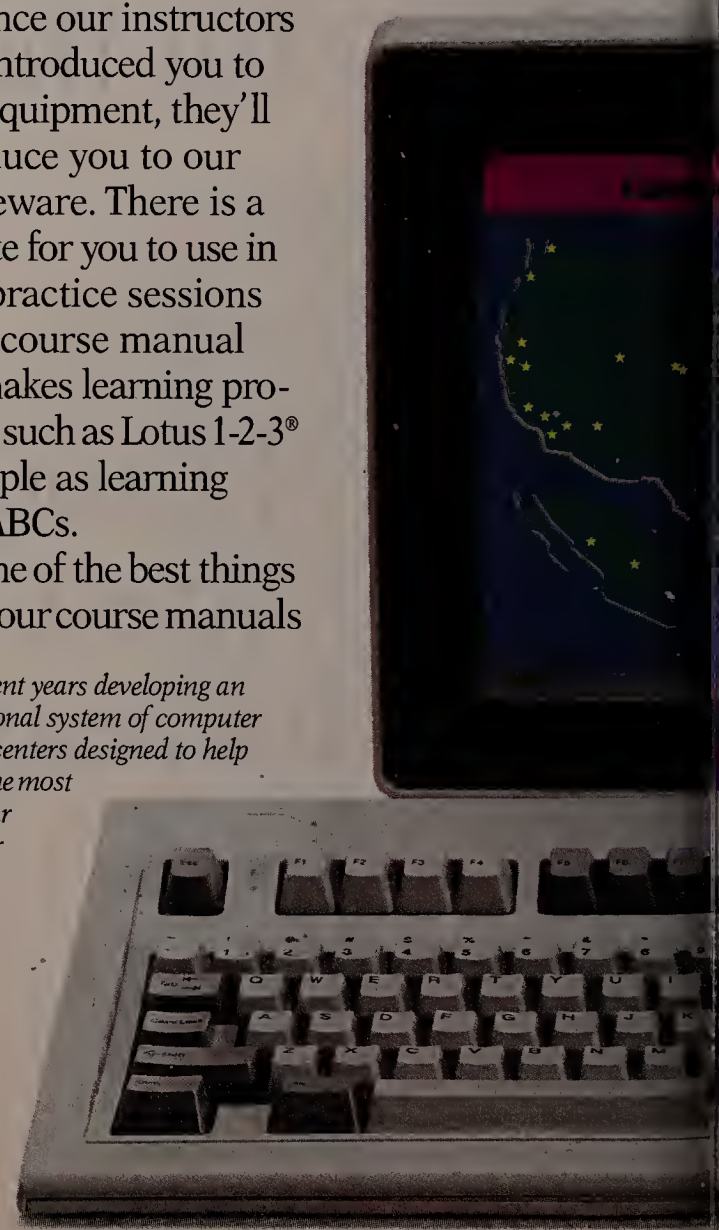

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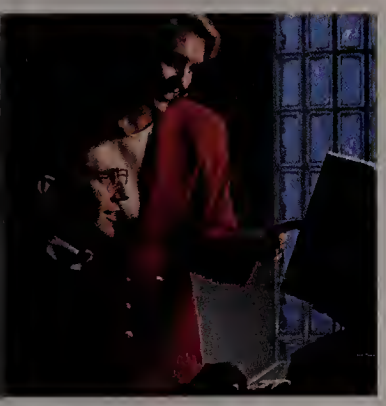

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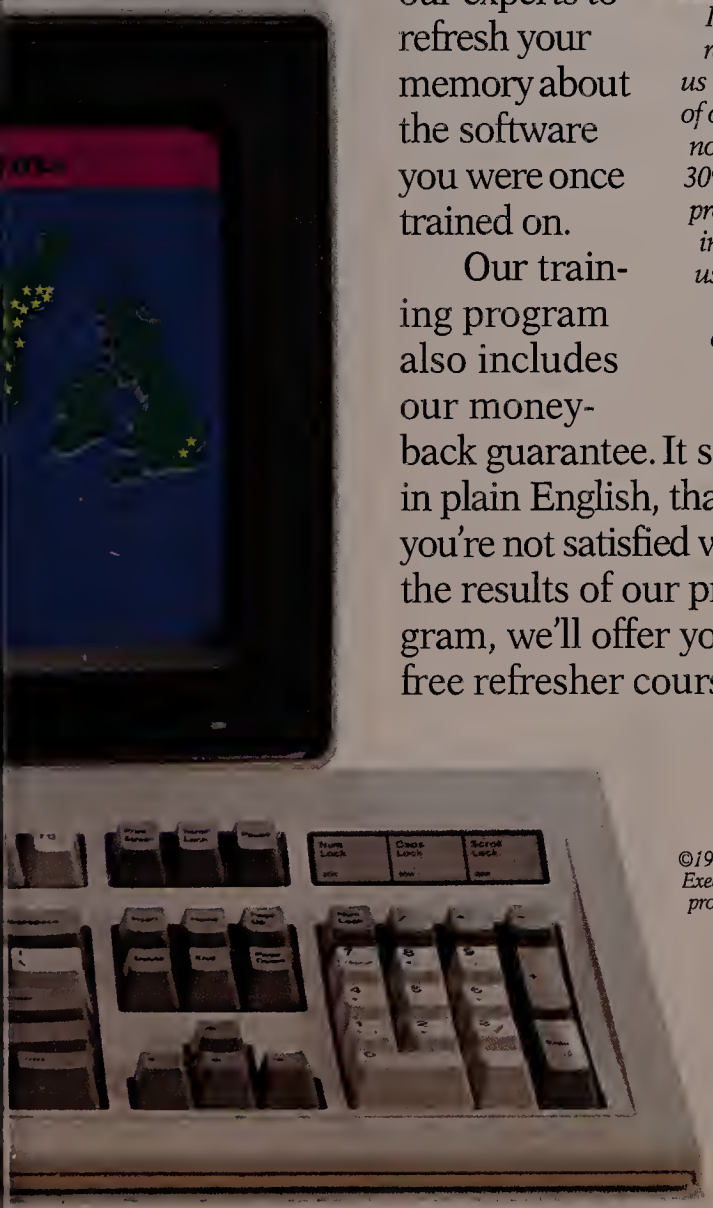

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Circle 82 on reader service card

Knowing how to change *GeoWorks* icons can be useful if you use Notepad often to edit files with a few particular extensions. I've enclosed a list [see "GeoWorks Icon Codes"] of valid icon codes (note that they're case sensitive).

One important point: *GeoWorks* scans the filenameTokens statements from top to bottom and chooses the first entry that matches each file name, so the line MYPROG.EXE = "FCAB",0 must come before *.EXE = "gDOS",0 or it will have no effect.

Ed Crowe, Oak Lawn, Illinois

Editor's note: If you use PC World Online, you've had some experience with the *GeoWorks* environment. This tip can come in handy if you decide to use that environment for more than simply downloading ready-made *Dialog Box* files. And speaking of downloading your *Dialog Box* files from PC World Online, the table of icon codes is available as GEOICONS.TXT, in the archive file DEC_DIAG.ZIP, in the "Featured in December" folder.

GeoWorks Icon Codes

DESK	File cabinet
FCAB	Open file cabinet
FLDR	Directory folder
FILE	Files in DOS box
gDOS	DOS in box
gDAT	GeoWorks symbol on stack of papers
gAPP	GeoWorks symbol
NPAD	Notepad
WPOO	GeoWrite
DPOO	GeoDraw
WDAT	GeoWrite file
DDAT	GeoDraw file
BANR	GeoBanner
NFCT	Nimbus Font Converter
3DFt	3-D Font Demo
DUMP	Screen dumper
PLNR	GeoPlanner
plnr	GeoPlanner file
PMGR	Preferences
AMOL	America Online
VIEW	Quattro Pro viewer
VEPS	Quattro Pro EPS file
VWQI	Quattro Pro file
VWK1	Lotus 1-2-3 file
TERM	GeoComm
ADBK	Address book
adbk	Address book file
PERF	Performance
CALc	Calculator
BONC	Bounce
TETR	Tetris
SOLI	Solitaire
Scrp	Scrapbook
scbk	Scrapbook file

You must know these codes to assign GeoWorks icons to DOS files.

No New Num Locks

My wife was annoyed that our AT compatible booted up with the 101-key keyboard's Num Lock turned on, so I wrote a DEBUG script to turn Num Lock off at boot time. You can do the same.

First, create an ASCII text file called NUMLOCK.OFF:

```
E40:17 0
Q
```

Make sure that both lines end with a carriage return, otherwise your system will lock up. Also, note that there are no occurrences of the letter *O* in the file; the first line contains two zeroes.

Once you've created the file, the command to turn off Num Lock is **DEBUG < NUMLOCK.OFF > NUL**. To be safe, it's a good idea to test the command from the DOS prompt before adding it to your AUTOEXEC.BAT file.

Douglas Miller, Pendleton, Indiana

Editor's note: This tip takes care of one of my pet peeves—systems that insist on turning Num Lock on at boot time. Note, however, that while the technique works on the vast majority of current systems, it fails on a few—mostly older PCs and XTs. And if it does work on an older PC, you may find that the program turns off Num Lock but leaves the light on—following which, the light is on when Num Lock is off and vice versa. But on most PC compatibles, this script is a simple and effective way to turn Num Lock off.

By Brett Glass

Have a macro, batch file, short program, or general tip you're proud of? Mail your tips to Dialog Box, PC World, *501 Second St. #600, San Francisco, CA 94107; or send them electronically to PC World Online, Dialog Box; Internet, rogue@well.sf.ca.us; MCI Mail, PC World Editorial; CompuServe, 74055,412; or 415/442-1891 (fax).* PC World *pays $25 to $200 for each tip used. Sorry, we cannot acknowledge unpublished materials.*

Brett Glass is a contributing editor for PC World.

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FUNDAMENTALS: WORD FOR WINDOWS 2.0 MACROS

CREATING MACROS

You can create a new *Microsoft Word for Windows* macro either by recording the actions you want automated or by typing *WinWord*'s WordBasic macro statements in the macro editor. To change an existing macro, you must use the macro editor.

You can record keystrokes and normal *WinWord* commands into a macro; you can't record mouse movements within the text or statements specific to WordBasic. In the macro editor, you can enter WordBasic statements allowing the macro to request input, use subroutines, and repeat actions. Each WordBasic statement must be on its own line.

You can store macros globally, which makes them available any time you use *WinWord*. Or you can store them in the template file that your current document is attached to, for use exclusively with documents attached to that template, unless the current document is attached to the 'Normal' template.

Record macro	**T**ools • **R**ecord Macro, type macro name, optionally select shortcut key, optionally type **D**escription, OK, **G**lobal/**T**emplate, OK, do actions to automate, **T**ools • Stop **R**ecorder
Create macro in editor	**T**ools • **M**acro, type name for macro, **G**lobal/**T**emplate, optionally type Descr**I**ption, **E**dit, enter macro statements, **<Ctrl>-<F4>**, **Y**es
Load existing macro into editor	**T**ools • **M**acro, select or type macro name, **E**dit
Rename macro	**T**ools • **M**acro, select macro to rename, Re**n**ame, type new name, **<Enter>**

Note: When you open the editor to create a macro, you will see:

Sub MAIN

End Sub

All macro statements must be inserted between these two lines.

Tip: When you're asked upon exiting *WinWord* or closing a document whether you want to save global glossary or template file changes, click No if you changed or created macros for the current editing session only.

ASSIGNING MACROS

To make a frequently used macro easier to run, assign it to a shortcut key, menu, or toolbar icon.

Assign macro to shortcut key	**T**ools • **O**ptions, **K**eyboard, **G**lobal/**T**emplate, select macro, press or select shortcut key, optionally select Ctrl+ and/or Shift+, **A**dd, Close
Assign macro to menu	**T**ools • **O**ptions, **M**enus, **G**lobal/**T**emplate, select menu and macro, optionally edit Menu **T**ext, optionally type description, **A**dd, Close
Assign macro to toolbar	**T**ools • **O**ptions, **T**oolbar, **G**lobal/**T**emplate, select icon or [space] in **T**ool to Change list, select icon in **B**utton: list, select macro, optionally type description, Change, Close
Run macro that isn't attached to shortcut key, menu, or toolbar	**T**ools • **M**acro; double-click macro, or select macro and **<Enter>**

Tips: Take care when assigning a shortcut key to a macro. Selecting **A**dd removes that key from the macro it's currently assigned to (if any). When assigning a macro to a menu, you can precede one letter in the Menu Text box with **&**. That letter will appear underlined and typing it when the menu is displayed will select the macro. Avoid duplicating the underlined letters of other options in that menu.

AUTOMATIC MACROS

WinWord automatically executes certain macros at specific times. To make a macro execute under particular conditions, give it the appropriate name.

Executes when you:	Macro name
load *WinWord*	AutoExec
exit *WinWord*	AutoExit
open existing document	AutoOpen
create new document	AutoNew
close document	AutoClose

Note: An AutoExec macro must be global rather than saved in a template. The other automatic macros can exist either globally or in a template, with the template macro taking precedence.

GETTING HELP WHILE EDITING MACROS

Find statement or function in alphabetical list	**H**elp • Help **I**ndex, WordBasic Programming Language, scroll to find, then click statement or function
Find statement or function by category (such as Editing or Merge)	**H**elp • Help **I**ndex, WordBasic Programming Language, WordBasic Cross Reference, scroll to find, then click category, click statement or function
Get help on statement or function already in macro text	Position cursor inside statement or function name, **<F1>**
Copy help example into macro editor	In help window, **E**dit • **C**opy, select example text, **C**opy, click inside macro at insertion point, **E**dit • **P**aste

TESTING WRITTEN MACROS

Prepare for debugging	Load macro into editor, load expendable test document, **W**indow • **A**rrange All, click in or select part of test document
Run macro	**S**tart
Step through macro one line at a time	**S**tep, examine results, repeat for next command
Step through macro one line or subroutine at a time	Step **SU**Bs, examine results, repeat for next line or subroutine
View variable values between steps	**V**ars
Change variable values between steps	View values, Set, type new value, OK
End stepping, run rest of macro	**C**ontinue
Stop running or stepping through macro	**<Esc>**
Run macro, viewing commands but not stopping	**T**race
Set macro to pause at a specific place	Click in macro window at desired place, **Stop** on line by itself

Tip: To activate macro execution buttons with the keyboard, hold down **<Alt>-<Shift>** and press underlined letter on macro button.

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WORD FOR WINDOWS 2.0 WORDBASIC MACROS

EDITING AND FORMATTING TEXT

Action	Macro code sample
Insert *text* at cursor	Insert "*text*"
Insert *variable* at cursor	Insert *variable*
Insert extended character at cursor via ASCII code *nnn*	Insert Chr$(*nnn*)
Insert hard return at cursor	InsertPara
Move cursor *n* characters	CharRight *n*/CharLeft *n*
Move cursor *n* words	WordRight *n*/WordLeft *n*
Move cursor *n* sentences	SentRight *n*/SentLeft *n*
Move cursor *n* paragraphs	ParaUp *n*/ParaDown *n*
Move cursor *n* screens	PageUp *n*/PageDown *n*
Move cursor to top/bottom of document	StartOfDocument/EndOfDocument
Select next *n* words	WordRight *n*,1
Select whole document	EditSelectAll
Assign selected text to *variable*	*Variable*$ = Selection$()
Change selected text to uppercase/lowercase/capitalize first letter of each word	ChangeCase 1/ChangeCase 0/ ChangeCase 2
Center current paragraph	CenterPara
Change font size of selected text by 1 point or to next fixed size	GrowFont/ShrinkFont
Single/double-space current paragraph	SpacePara1/SpacePara2
Boldface/unboldface selected text	Bold 1/Bold 0 '0

Related commands: LeftPara, RightPara, JustifyPara, Indent, UnIndent, HangingIndent, Unhang, Italic, Hidden, Strikeout, Underline

Tips: To move the cursor one unit, such as a character, word, or paragraph, omit the *n* argument. You can use the ,1 select argument (as shown in "Select next *n* words") with any of the cursor movement statements. To be sure your macro unselects any current selection before it selects a new one, use a cursor movement command without the select argument, then with it.

COMMUNICATING WITH USERS

Display *text* on status line	Print "*text*"
Display contents of *variable* on status line	Print *variable*
Display *text* and *variable* on status line	Print "*text*"; *variable*
Display *text* in pop-up box	MsgBox "*text*"
Prompt user on status line for input to assign to *variable*	Input "*prompt*" *variable*$
Prompt user in dialog box for input to assign to *variable*	*Variable*$ = InputBox$("*prompt*")

Related statements and functions: Line Input, MsgBox()

Tip: InputBox$() always returns a string variable; you can use Val(InputBox$()) to assign input to a numeric variable.

PROGRAM CONTROL

For all but the simplest macros, you need to do more than simply step through the statements one at a time. The operations below can help you repeat parts of a macro or skip statements when they're not appropriate. Each statement must be on its own line.

Create label *MyLabel*	*MyLabel*:
Jump execution to label *MyLabel*	GoTo *MyLabel*

PROGRAM CONTROL (continued)

Create subroutine *MyRoutine*	Sub *MyRoutine* *statement(s)...* End Sub
Run subroutine	*MyRoutine*
Repeat *statement(s)* *n* times	For x = 1 to *n* *statement(s)...* Next x
Do *statement* if *condition* is true	If *condition* then *statement*

Do *statement(s)* if *condition* is true	If *condition* then
	statement(s)...
	End If

Do *statement(s)* if *condition* is true or other *statement(s)* if *condition* is false	If *condition* then
	statement(s)...
	Else
	statement(s)...
	End If

Repeat *statement(s)* while *condition* is true	While *condition* *statement(s)...* Wend

Note: A label must start at the left margin.

Related Statement: Select Case

Fold Here

WINWORD MENU COMMANDS

A macro can execute *WinWord* menu commands. Most menu command statements consist of the menu name plus the menu command. Statements for a menu command that normally displays a dialog box can accept an argument for each dialog box item.

Save current file	FileSave
Open file *MYFILE.DOC*	FileOpen .Name = "*MYFILE.DOC*"
Display/hide print preview	FilePrintPreview
Find next occurrence of *text*, whole words only, case sensitive	EditFind .Find = "*text*", .WholeWord = 1, .MatchCase = 1, .Direction = 1
View full page	ViewZoomWholePage
View at 100%	ViewZoom100
Format character font and size	FormatCharacter .Font = "*font*", .Points = *n*
Check spelling	ToolsSpelling
Insert 10-column, 5-row table	TableInsertTable .NumColumns = 10, .NumRows = 5
Display all document windows	WindowArrangeAll
Display help index	HelpIndex

Notes: An argument with a period prefix corresponds to a dialog box item; if the argument is omitted, the default or current value is assumed.

OTHER MACRO CAPABILITIES

For information on the statements and functions below as well as others, see the Help system or the *Microsoft WordBasic Developer's Kit*.

Standard Basic commands: Abs(), Asc(), Beep, Date$(), Declare, Function...End Function, InStr(), Int(), LCase$(), Left$(), Len(), Mid$(), Time$. **File I/O:** Open...For...As, Close, Eof(), Lof(), Input, Input$, Print, Read, Write, Seek. **Dialog box tools:** Begin Dialog...End Dialog, ComboBox, CheckBox, ListBox, TextBox, GetCurValues. **Dynamic Data Exchange (DDE):** AppActivate, DDEExecute, DDEPoke, DDEInitiate, DDETerminate. **Mail merge:** FileCreateDataFile, FilePrintMerge, InsertMergeField, FilePrintMerge-ToPrinter. **Bookmarks:** BookmarkName$(), GetBookmark$(). **Glossary:** ExpandGlossary, Spike. **Outlining:** OutlineCollapse, OutlineExpand, OutlinePromote, ShowAllHeadings

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	8Meg Module	116561-001	289.00
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	4Meg Module	113132-001	159.00
DeskPro 386S-16MHz	1Meg Exp 8d	113633-001	110.00
	4Meg Exp 8d	113634-001	219.00
	1Meg Module	113646-001	75.00
	4Meg Module	112534-001	159.00
DeskPro 386/20E	1Meg Exp 8d	113644-001	119.00
DeskPro 386/25E	4Meg Exp 8d	113645-001	219.00
	1Meg Module	113131-001	75.00
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DeskPro 286N, 386N, 386SX/20, 386/25M, 486/33M, 486S/25M, 486S/16M	1Meg Module	118688-001	50.00
	2Meg Module	118689-001	85.00
	4Meg Module	118690-001	149.00
	8Meg Module	128877-001	319.00
DeskPro 386/16	1Meg Kit	108071-001	99.00
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Compaq SLT/386	1Meg Module	118303-001	79.00
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T2000SXE/2200SX	8Meg	PC-PA2002U	309.00
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T4400SX, SXC T6400	4Meg	PC-PA2004U	209.00
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T4400SX,SXC T6400	16Meg	PC-PA2010U	799.00
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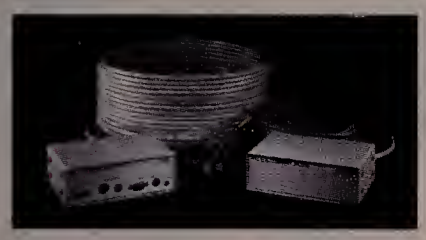

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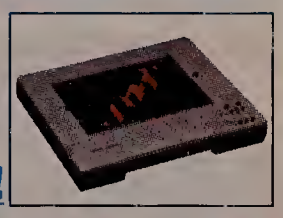

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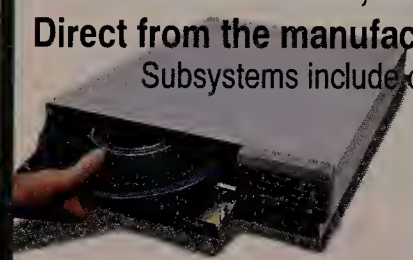

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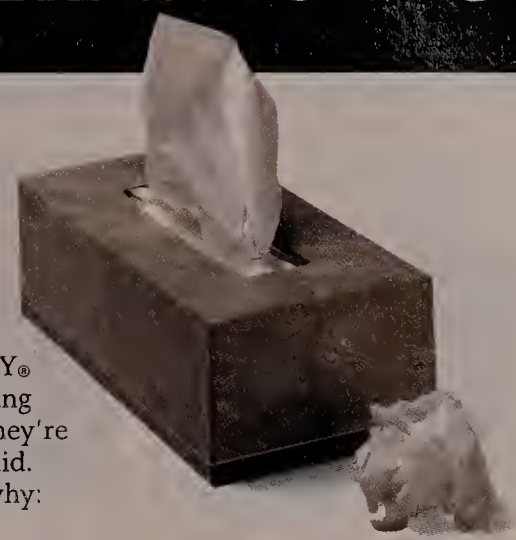

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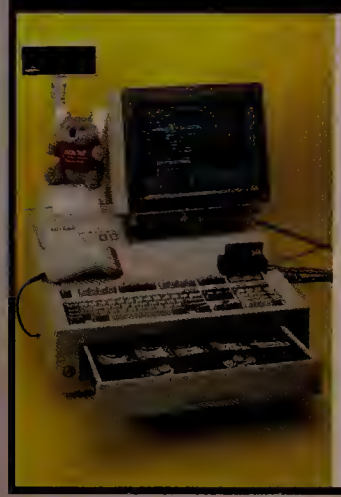

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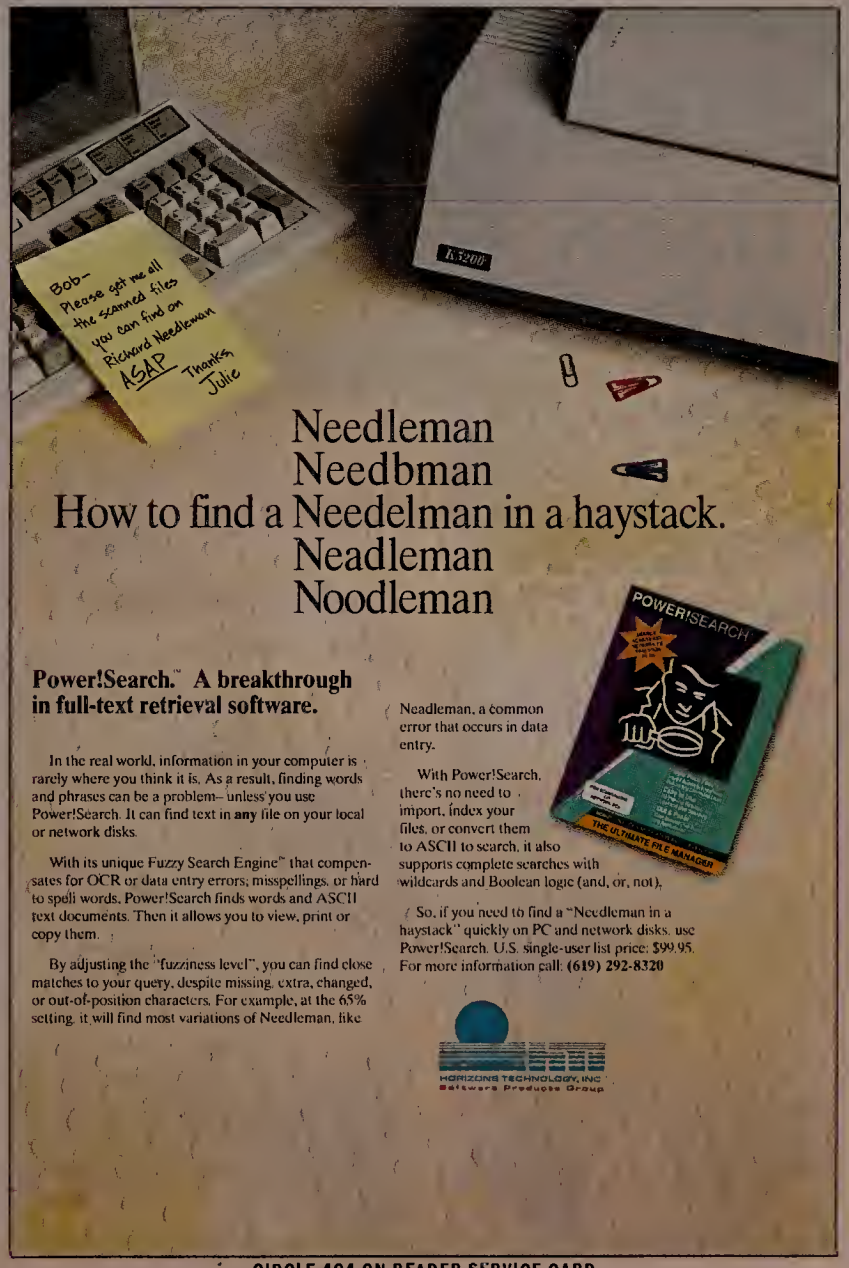

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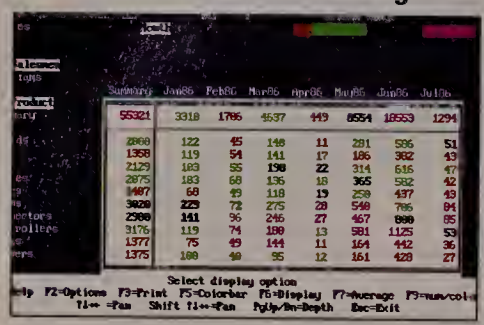

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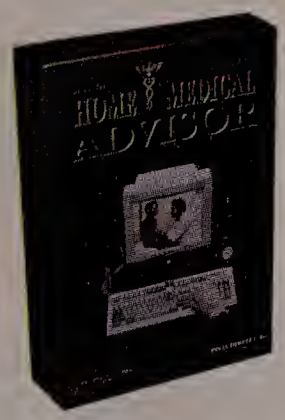

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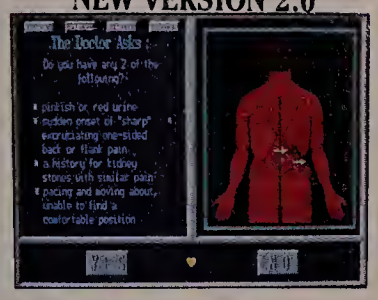

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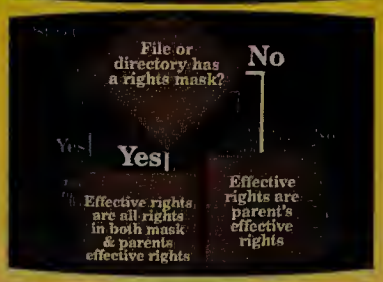

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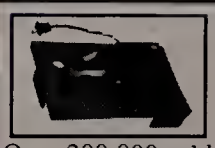

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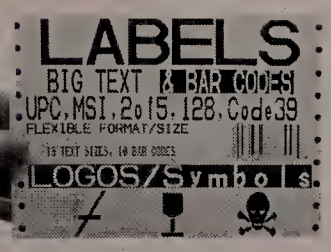

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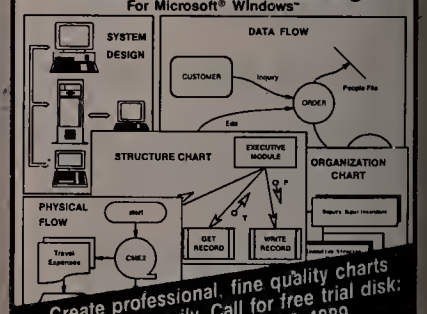

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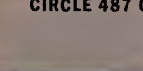

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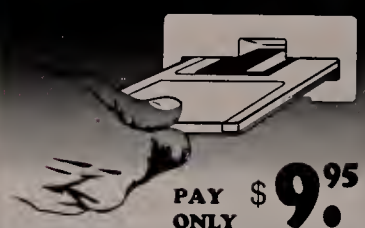

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952 Notebook computers
953 DTP/Presentation software
954 Monitors and video boards
955 Accounting software
956 Draw/paint software
957 Network/sharing products
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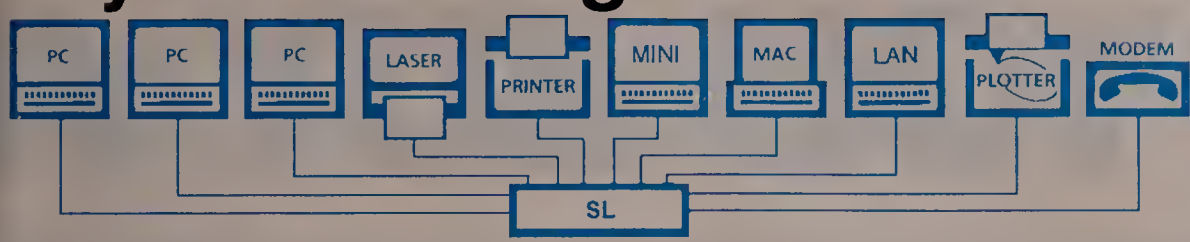

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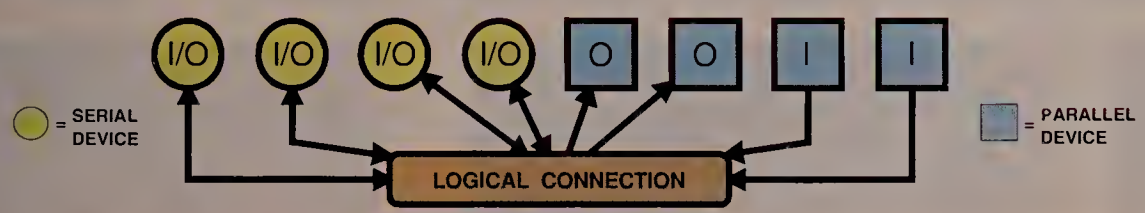

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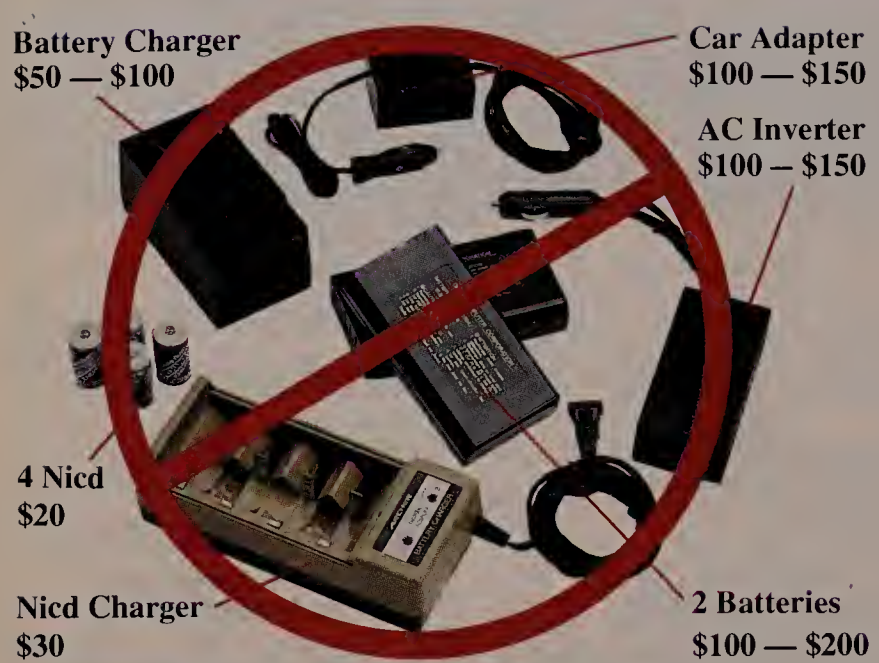

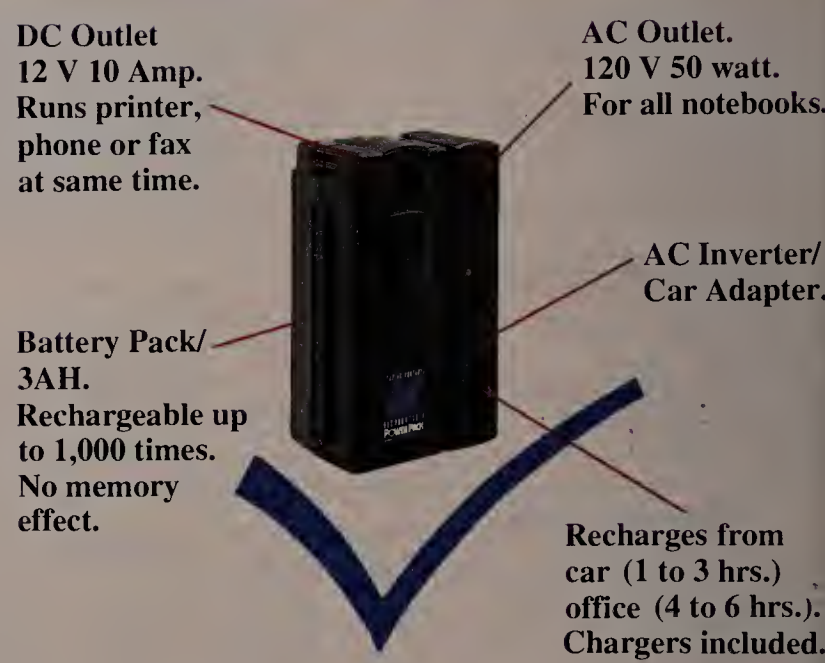

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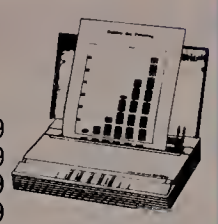

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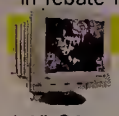

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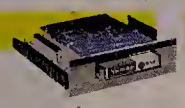

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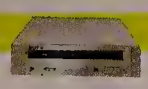

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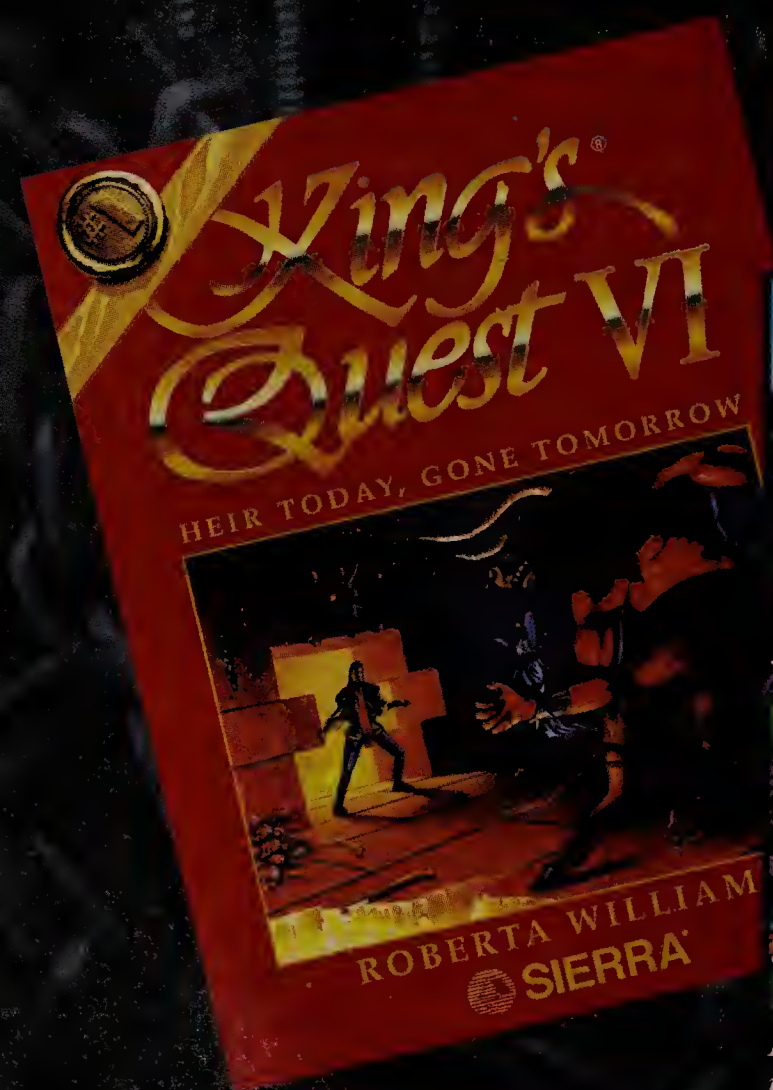

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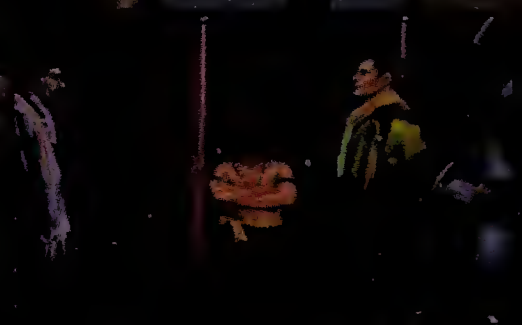

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Old and New Favorites: From Chess to LucasArts

Creative play is the highest form of intelligence. Quite aside from the mental and physical benefits of relaxing your mind by taking a few moments off from work, playing some computer games actually hones your creative abilities and returns you to work sharper, faster, and more effective.

Obviously, I don't mean the fast-reflex, nuke-the-space-bugs, arcade-type games—which may be fun but are clearly designed to produce better fighter pilots, not better managers. I mean role-playing games, strategic games, empire-building games that reward resourceful problem solving. They develop management skills like concentration under pressure, imaginative improvisation, and better computer proficiency. Oh yeah—and they're fun, too.

Computer games have come a long way since the days of Pong. This column will track the latest and coolest and help you make the most of your precious, playful moments. Let the games begin.

Le Rouge et le Noir

Chess is one of the world's oldest battle games. It's also one of the best ways to polish combat strategies, sharpen analytical skills, and develop the determination to grind competitors underfoot.

Computer chess programs go all the way back to 1939, when British computer pioneer Alan Turing developed the first set of formulas to let a chess computer compete with a human opponent. Turing thought it would be 100 years before a machine could actually play the game.

Cut to 1992. *Chessmaster 3000 Multimedia Pro* (which requires *Windows*, a CD ROM player, and a soundboard) can wipe the floor with 98 percent of the chess players in the world. But since it doubles as a terrific chess teacher, you may be able to turn defeat into victory.

You can customize the interface 12 ways against Sunday, choosing a 3-D or 2-D board, playing with different chess sets, and setting up multiple windows to show clocks, captured pieces, written analyses, and much more. You can even place the game in a small window so you can work on, say, a business report spreadsheet while you think about your next chess move.

Chessmaster not only will play against you (at many different skill levels, so even beginners can win), it will tutor you in the basic principles of board coverage. It will show you how the pieces move, step you through 150,000 classic openings, share strategies, and provide hints when you get in a tight spot—all with appropriate multimedia animation and sound.

The Mentor feature, which provides hints, advice, and analysis in spoken, conversational English, is slow, and now and then the speech synthesis sounds like Tic-Toc the Mechanical Man. But it still beats the hell out of taking your eyes off the board to read a paragraph of chess notation.

The most entertaining part of *Chessmaster 3000 Multimedia Pro* is its library of classic games. You can call up some of the greatest contests in history, from 1790 to 1986, and the games play out in full animation. At any point you like, you can even "take the controls"—stepping in for Bobby Fischer, say—but you'll need a human adversary because the computer won't take over your opponent's play. This new edition includes ten classic games by world champion Anatoly Karpov, with 5 hours of spoken play-by-play commentary and analysis from Karpov himself.

Chessmaster's 3-D board display lets you open windows for advice and a list of possible moves. The pieces shown in light red are threatened by white.

Role Playing, LucasArts Style

The new multimedia edition of *Loom*, LucasArts Games' innovative and charming role-playing game, requires both a CD ROM player and a soundboard—but it may be worth installing the hardware just to play. With a CD audio soundtrack featuring music, sound effects, and a large cast of actors, this game has turned into an interactive fantasy-adventure film that unreels on your PC's screen—with you in the starring role.

As with the original disk-based version, you play the role of Bobbin, a young weaver in a world ruled by magic. The game begins with a long, fascinating animated sequence in which a strange power sweeps your universe into oblivion. Then you take over, moving through the world via your mouse and a musical "distaff" that casts spells with secret melodies.

By Michael Goodwin

As Loom rushes toward its exciting climax, you find yourself in evil Bishop Mandible's calaboose. The monster in the neighboring cell is not your friend.

The story line is classic fantasy stuff, spiced up by dialogue written in part by respected science fiction novelist Orson Scott Card. You adventure through a series of fabulous settings and end in a climactic sequence that's as terrifying as it is thrilling.

There are a few problems with the CD version: Now and then the dialogue stutters as the CD player strains to keep up with the action. Also, some sequences appear to have been simplified. For instance, a long, charming conversation with a chatty dragon—one of my favorite parts of the original game—has now been transformed into a short, businesslike discussion. Moreover, there's only one story line, and once you've "won" by getting to the end, there are no further surprises.

But the primary delights of *Loom* remain: The sophisticated story is captivating, the graphics are breathtaking, and the playing interface is elegant. Best of all, you can solve every game problem with deeper thought or sharper concentration—and that sounds like the real world to me.

• **Chessmaster 3000 Multimedia Pro** $99.95; Software Toolworks; 415/883-3000

Reader service no. 806

• **Loom, CD Edition** $79.95; LucasArts Games; 800/782-7927

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Michael Goodwin is an associate editor for PC World. *He can be reached on PC World Online (see page 8 for more information).* ■

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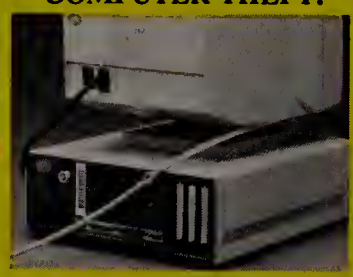

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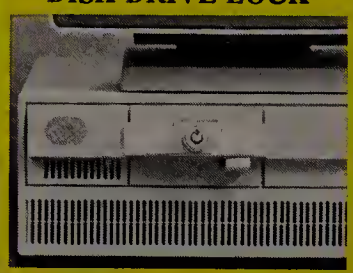

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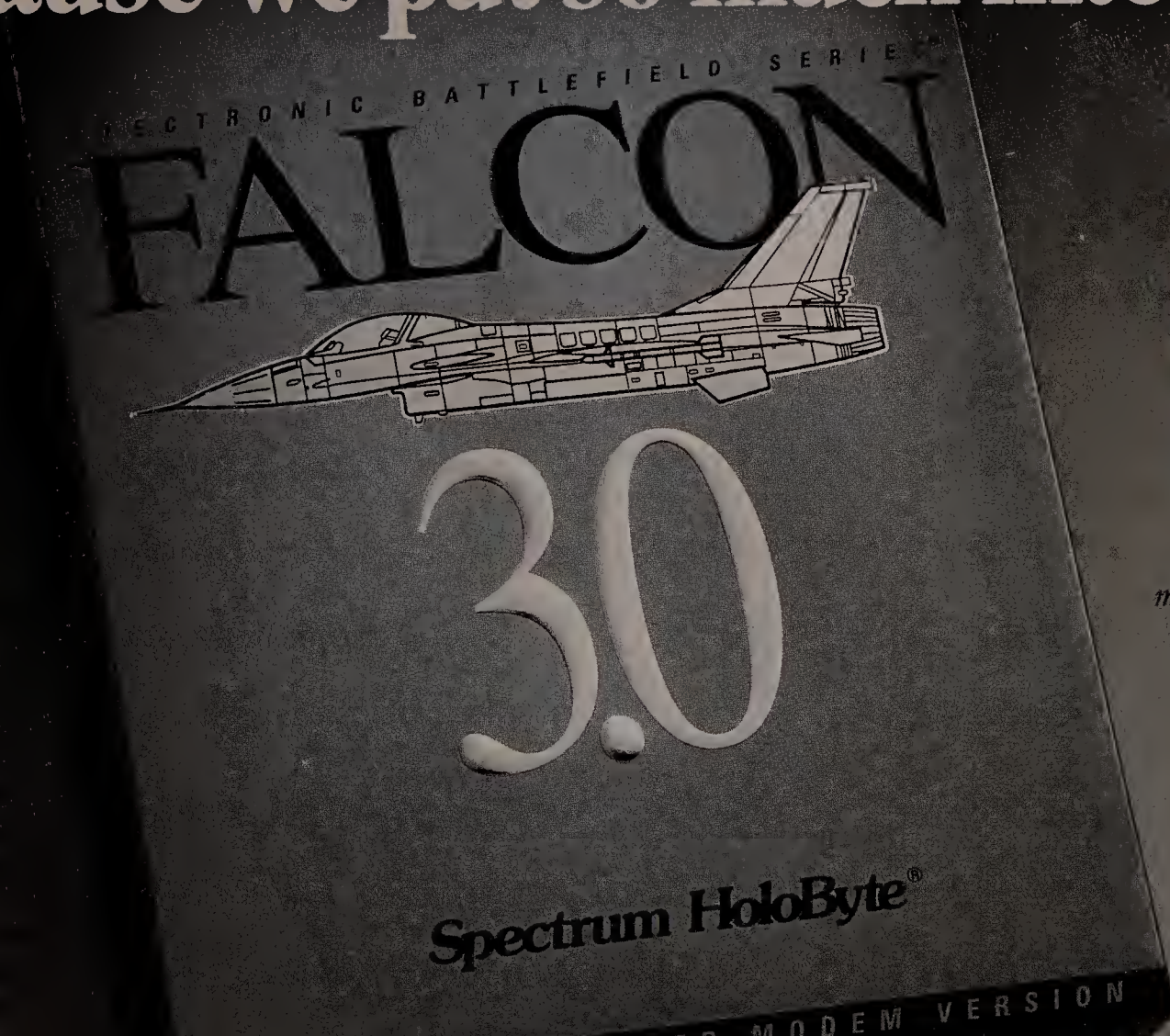

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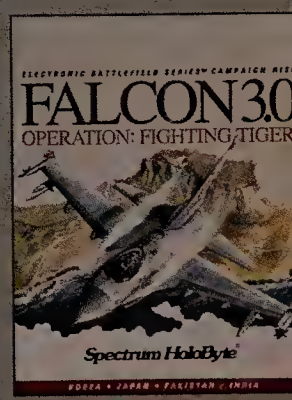

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Working Smarter With On-Line Services and BBS's

I depend on electronic BBS's and on-line services for messages, stock quotes, talking with my editor, and getting the latest shareware, among other uses. I log on to at least six of these services every day, sometimes more than once. Many are hard to navigate, taking a toll in time and money.

But I've discovered some handy—often spectacular—programs that automate access to public on-line services such as America Online and CompuServe and to private bulletin boards.

I like CompuServe, but navigating it is on-line hell and scares off all but the stouthearted. It cost me over $100 the first month, and I spent most of that money just finding my way around.

CompuServe Made Easy

I now use *OZCIS*, a sensational auto-navigator program for CompuServe mail, forums, and other services. It lets me get in, take care of business, and get out at a minimal cost. I do all the time- and money-consuming work—reading messages, writing responses, and checking forums—off line. When I started using *OZCIS*, I immediately saw a 40 percent savings on my CIS bills.

OZCIS is as easy to use as CompuServe is difficult to navigate. I can easily customize the way *OZCIS* handles each forum. For example, on one forum I can get a list of new files available for downloading, along with all new messages. On another forum I can ask for a quick scan of message titles. I can also go on line, check for and send personal mail, and ignore the forums entirely. Off line, I use *OZCIS*'s built-in editor to write messages and easily cut and paste data into replies. There's also full mouse support, pulldown menus, and context-sensitive help.

I know precisely how much *OZCIS* saves me because it tracks on-line time and charges—perfect for billing for time on line. *OZCIS* also appeals to my recession mentality because it's *free* to individuals. (The fee for commercial use is $50.)

OZCIS has a *Windows* version in the works, but if you're addicted to *Windows*, you need something now. Take a look at CompuServe's *CIM for Windows* (see *New Products* in last month's issue). As with *OZCIS*, you can do your work off line, but *CIM for Windows* also gives you *Windows*' familiar interface, and enables you to take advantage of such features as the Clipboard to copy graphics and paste them into your documents or messages in other forums.

That works great on CompuServe, where I spend most of my time, but private BBS's require a different approach. Some private BBS's are free but require toll calls that result in hefty phone bills. Others charge a yearly fee and limit my access time. To get on and off in a hurry, I tried using my communications program's scripting language to accomplish my on-line chores. That's *also* for the stouthearted.

BBS Robotics

Then I discovered *Robocomm*. This amazing shareware program automatically logs on to a BBS; collects all the messages, new file names and descriptions, and bulletins; archives them into one compressed mail packet; and downloads it all to me. I read and respond to the messages off line, tag the files I want downloaded, and then have *Robocomm* log on to the BBS and carry out my instructions. I can even get *Robocomm* to use my antivirus program to automatically scan for viruses in files immediately after downloading them.

Robocomm's scheduling capability is even more exciting. Using an easy interface, I tell *Robocomm* to log on to certain BBS's on Monday and Friday, and others on Saturday mornings, for example. The Executive Network BBS charges less for night-time access, so I can set *Robocomm* to dial in at midnight, taking advantage of their lower rates.

The catch is, *Robocomm* works only on *PC Board* or *Wildcat* BBS's. That's not a major problem, however, because most BBS's use one of these two host software packages.

Automating my BBS chores gives me more time to work on this column. All I need now is a program that'll write it automatically.

Contributing Editor Steve Bass is a family therapist and president of Pasadena IBM Users Group. He can be reached on PC World Online.

by Steve Bass

ANTHONY RUSSO

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